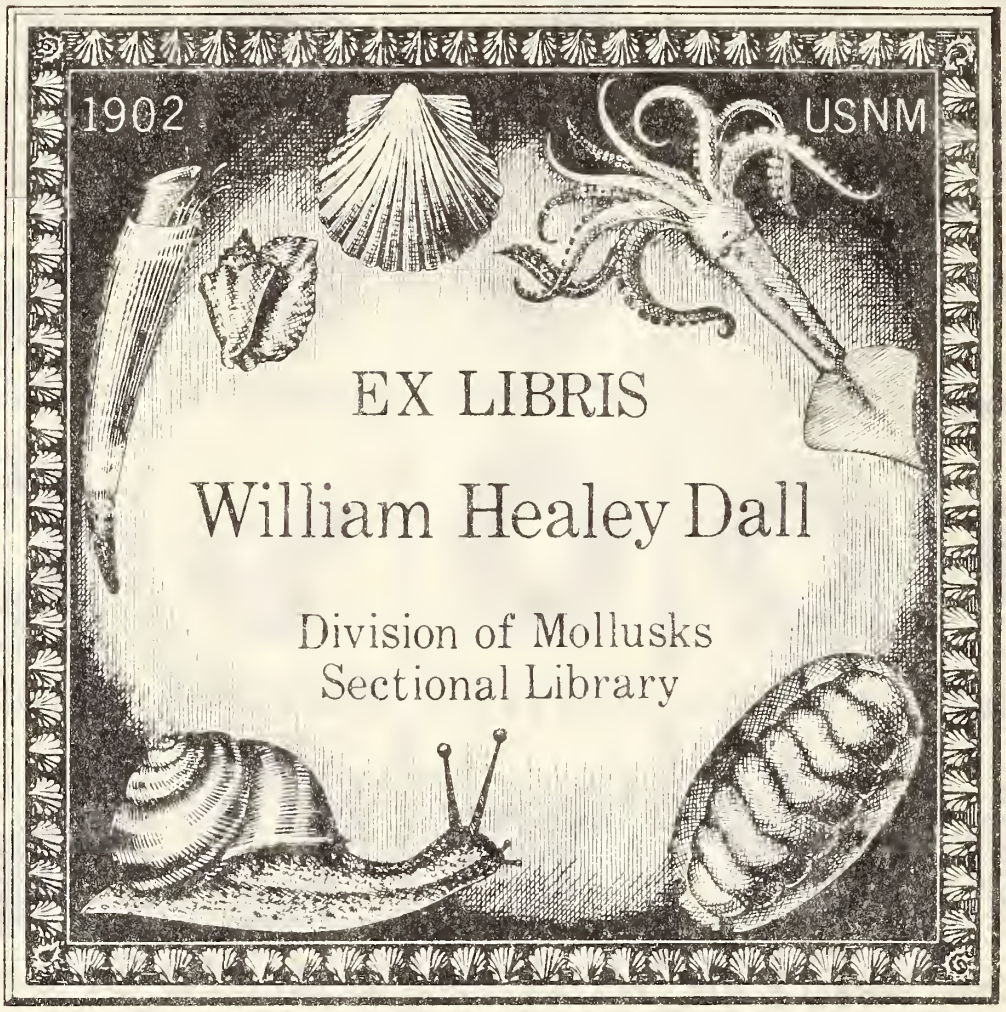
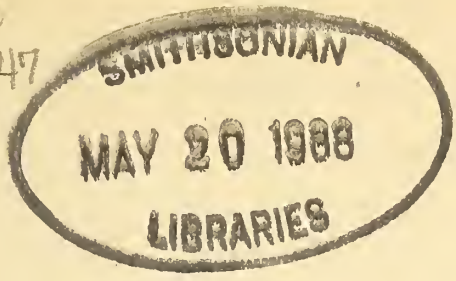

1902
USNM
EX LIBRIS
William Healey Dall
Division of Mollusks
Sectional Library

SMITHSONIAN INSTITUTION LIBRARIES

Division of Mollusks
Sectional Library

QL
430.5
C38M47
1887
Moll.



Division of Mollusks
Sectional Library

no T. Proc'd.

Monograph of the Genus

STROPHIA,

A Group of Tropical and Sub-tropical Land Shells.

By Charles J. Maynard.

INTRODUCTION.

Having had somewhat extended opportunities, during several collecting trips through the Florida Keys, Bahamas, and some of the West Indies, of studying the habits of the genus Strophia, I have decided to write a monograph of them. I am prompted to do this, partly because, as I have met with some twenty species living, many of which appear to be new to science, and thus know something of them, but mainly because there seems to be the utmost confusion in regard to the nomenclature of known species; insomuch so, in fact, that it becomes necessary to refer to the original description of each and every species, or to see types, before a decision can be made as to the proper name which should be applied to any given species.

Through the kindness of Prof. Alex. Agassiz, I have been allowed to examine the extensive collection at the Museum of Comparative Zoology at Cambridge, where Dr. J. W. Fewkes who has charge of the Mollusks, has given me every facility for prosecuting my researches.

Strophia has usually been regarded as a sub-genus of Pupa, but aside from the fact that I do not believe in sub-genera, I am sure that the present group is sufficiently characteristic to receive full generic rank. See further remarks upon this subject, under head of General Conclusions.

The group is an exceedingly plastic one, species becoming evolved quite readily. This is largely due to the sluggish habits of the animals; they not only remain quiescent at least six months in the year, attached to herbage or shrubbery, but judging from what I have seen of them, it is probable that individuals pass their entire lives in the area of a few

square yards. A comparatively narrow strip of sand, or naked soil or rock, would be sufficient to isolate a colony, and a colony so isolated, speedily acquires specific characters. As a rule, a given species occupies a very limited area, sometimes a few square rods on a small island upon which there may be several other species. Generally species do not mingle, even if a given species be distributed throughout a section occupied by others, each will frequently be found gathered in groups, apart from the others. I have, however, found species intermingling.

Conchologists may take exception to some of my new species, thinking, perhaps, that I have used too trivial characters in separating them. Believing, however, as I do, that it is the imperative duty of naturalists today, to record minute points of differences among animals, and when these differences are sufficiently constant to indicate specific rank, to emphasize them by giving the group, so signalized, a name, I have not hesitated so to designate them, if for no other reason than for the benefit of the coming generations. As may be expected, in so recently formed species as some of the STROPHIA appear to be, there is much reversion in certain individuals toward ancestral types, producing what might at first sight be considered as intergrades, or rather the result of a union between two individuals of separate species, but among the large number of this genus that I have examined, at least 50,000 specimens, I have yet to see one which does not present characters that refer it to a given species. I have worked the vast amount of material that has come into my hands, with the greatest care, and have come to the conclusion that there are only two alternatives; either to call all of the STROPHIA one species, or to devide them as I have. Ten years ago, I might have thought the former named expedient advisable; now I think otherwise, and the species of STROPHIA given in this monograph, are the results of my studies.

C. J. M.

NEWTONVILLE, MASS., JAN., 1889.

NOTICE

AFTER CAREFUL EXAMINATION OF THE
INNER MARGIN AND TYPE OF MATERIAL
WE HAVE SEWN THIS VOLUME BY HAND
SO IT CAN BE MORE EASILY OPENED
AND READ.

Genus **STROPHIA** Albers.

Gen. Ch. Shell, varying in form from oblong-oval to cylindrical, but the width is never more than half the length and usually less, sometimes being only one third. The apex is pointed, occasionally obtusely, but the angle never measures more than 90 degrees, and when acute, it is never less than 50 degrees. The whirls vary from nine to twelve, the lower are very narrow but they rapidly become wider as they ascend, the last, with the margin of the aperture, occupying about one-half of the length of the shell. The whirls are usually furnished with prominent perpendicular striations, but are occasionally smooth. The margin of the aperture is quite prominent, produced forward so that the face is parallel with the sides of the shell, with the edges rolled backward and often thickened. Crossing the lower portion of the aperture, inclined downward to the right, is a more or less prominent frontal bar that connects the lower parts of the margin. The aperture narrows quite rapidly within, and there is a prominent tooth near the center of the lower wall and usually a second one on the column; this latter named is not always present. Young shells which are incomplete, inasmuch as the aperture is not surrounded with a margin that is produced forward, as in the adult, and which consist of fewer whirls, more or less, according to age, have as a rule, five teeth, of which two are on the upper wall, two on the lower wall, and one on the column. These teeth become absorbed as the shell grows and others take their place further in advance, hence, if they be well within the aperture, they are often less than the normal number. The spirally ascending, parietal walls are very thin, Plate II, 1c, while the wall of the hollow column, Plate II, 1c, which opens outwardly, back of the left of the aperture, is also thin. On the other hand, the outer walls which are made up of at least two layers, the outer calcareous and the inner more horny, are thick and often quite massive. In size the shells vary from .60 in length by. 25 in diameter, to 2.60 by .60, with all gradations between.

In color, outwardly the shells are usually white, often flecked or striped with purple, reddish purple, or rosy; inwardly they are either roseate or purplish of varying shades.

The animal is not large for the size of the shell, the foot, with head and eye peduncles, being about as long as the shell. The foot is slender, narrower than the aperture, about two thirds as long as the shell; beneath, it is smooth and provided with numerous pores that exude a mucous with which the animal lubricates the surface over which it glides. The

foot above, in common with the entire exposed surface of the body, including the eye peduncles and tentacles, is covered with minute tubercles that are arranged in regular rows; see Plate I, 13, for head and upper surface of the body. The body is rather wider than the foot and tapers to the quite narrow head. Eye peduncles, Plate I, 13, EP, are prominent but slender and about one third as long as the shell, enlarged terminally where there is a prominent eye speck, Plate I, 13, ES. The tentacles, Plate I, 13, TT, are short, not over one third as long as the eye peduncles. Mantle, Plate I, 5, M, large, completely enfolding the body and a portion of the foot when the animal withdraws within the shell. All the figures on Plate I are greatly enlarged.

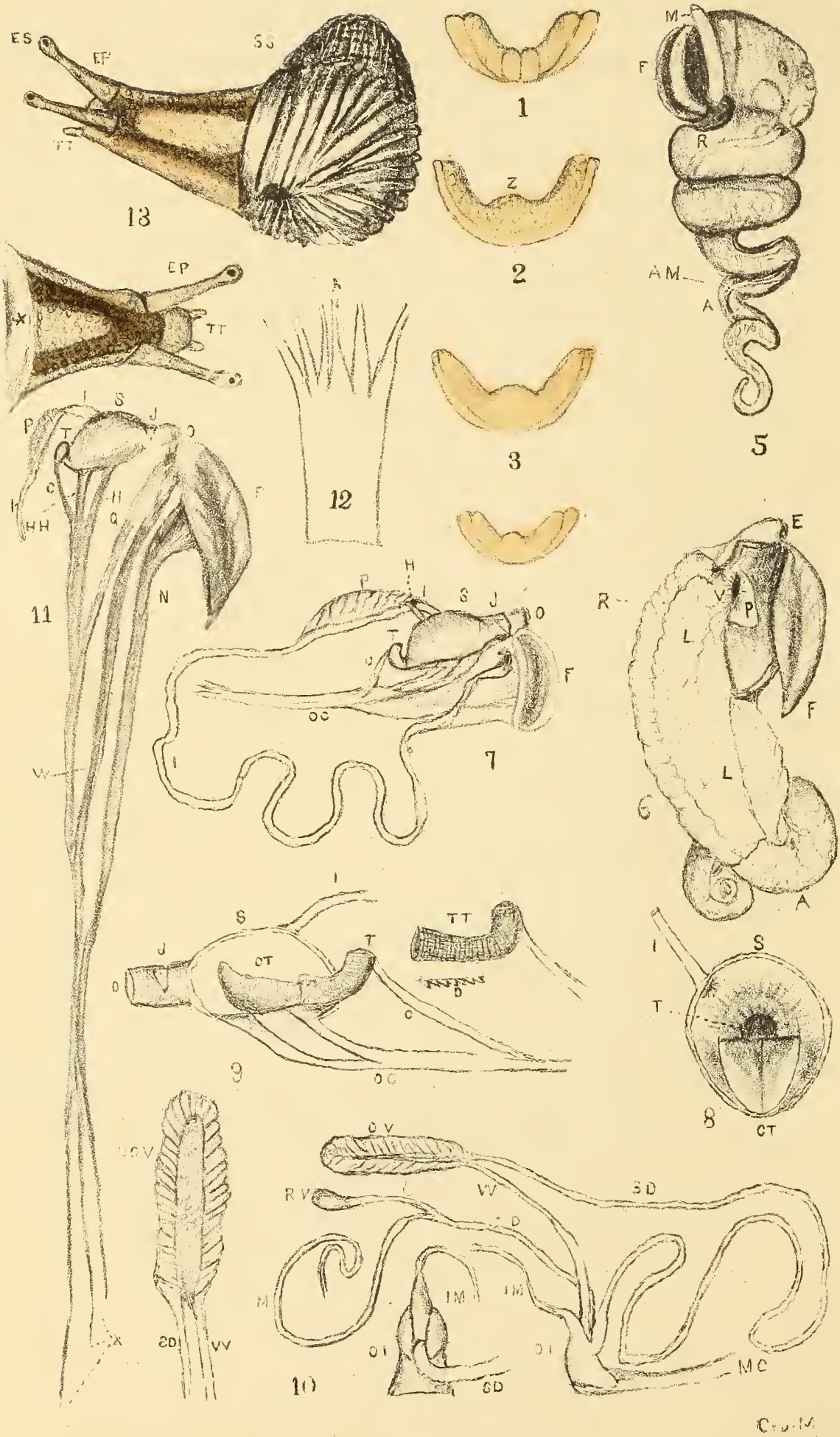
The color of the external portions is pale horn, more or less striped with black or dark brown, and occasionally the entire upper portions are so colored.

Upon removing the animal from the shell, the mantle will be found to cover the entire surface of the body, quite to the point of the elongated abdomen which occupies the interior of the lower five whirls to the tip, Plate I, 5, A, where the left side of the animal is represented. The mantle is smoother and thinner where it is not exposed than it is on the anterior portions.

The mouth opens directly beneath the tentacles, Plate I, 7, 9, 11, O; and the entrance, in the contracted animal, is a gullet capable of being protruded as far as the jaw, ib., 7, 9, 11, J. This organ is embedded in the muscles of the gullet, is crescent shaped, horny, and bright amber colored, and the horns of the crescent point downward, thus exposing the inner margin which is the cutting edge. There is considerable specific variation in the form of the jaw, and some individual, thus on Plate I, 1 & 3, I have given two jaws of different specimens of Strophia copia, 3, however, being the usual type. The jaws of all the species that I have examined, agree in certain general characters, and appear to be made up of two parts, a lower, thicker portion, which becomes sharpened into the cutting edge, in the middle of which is a kind of blunt tooth, Plate I, 2, Z, and a thinner upper portion that edges the lower and which is embedded in the muscles, 2, X, where a jaw of S. pannosa is represented. Fig. 4 shows a jaw of the smallest species of the genus known to me, S. nana, from Little Cayman. The cutting edge of the jaw is opposed by the soft, muscular, inner surface of the gullet only.

The gullet opens just behind the jaw, into a wider, egg shaped chamber, Plate I, 7, 8, 9, & 11, S. This organ which is usually called the mouth, lies on the back, and a little to the right. Externally, at the

PLATE I.


ES
EP
SS
TT
13
1
Z
2
M
F
R
AM
A
5
EP
TT
3
A
12
I
S
J
P
T
O
C
H
HH
Q
F
11
N
W
P
H
I
S
J
O
T
C
F
OC
I
7
E
R
V
P
L
F
L
6
A
I
S
J
T
TT
D
OT
C
9
OC
I
S
T
D
8
CT
OCV
RV
W
SD
D
M
IM
IM
OI
OI
MC
SD
10
OCV
X
SDI
VV

C. J. M.

EXPLANATION OF FIGURES ON PLATE I.

1. Unusual form of Strophia copia.

2. Jaw of Strophia pannosa; Z, blunt tooth; X, thin edge.

3. Jaw of Strophia copia, usual form.

4. Jaw of Strophia nana.

5. Left side of animal of Strophia pannosa; M, mantle; F, foot; R, rectum; AM, end of intestine; A, abdomen.

6. Right side of animal of Strophia pannosa; E, eye; P, flap to ventral opening; V, ventral opening; R, rectum; L L, lungs; F, foot.

7. Alimentary canal of Strophia copia; O, entrance to mouth; J, jaw; S, proventriculus; I, œsophagus; P, solvent glands; H, duct to same; I, termination of stomach and beginning of intestines; T, cylindrical organ of tongue; C, retractor muscle of same; OC, supporting muscle; F, foot.

8. Interior of mouth, or proventriculus; S, walls; CT, tongue; T, entrance to cylinder; I, œsophagus.

9. Side view of above; O, gullet; J, jaw; S, walls; CT, tongue: T, cylinder; TT, same detached; D, teeth of same; C, retractor muscle; oc, large muscle.

10. Reproductive organs of S. copia; OV, combined ovaries and testes; SD, spurm duct; VV, oviduct: OOV, more enlarged view of same; RV, spurm reservoir; M, accessory organ of same; OI, intromittent organ, IM, retractor muscle, and to the left, is a more enlarged view of same; mc, muscle.

11. Muscular system; N, lower muscle; W, right upper muscle; Q, left; oc, stomach muscle; H, lower branch of same; HH, upper; C, abductor muscle of cylindrical organ T; X, terminus of clinging muscles; other letters same as in No. 7.

12. Terminus of tongue muscle; X, fascicles.

13. Animal of Strophia pannosa; SS, shells; TT, tentacles; EP, eye peduncles; ES, eye specks.

back of this mouth, protrudes a cylindrical, upturned organ, ib., 7, 9, & 11, T, at the outward extremity of which, is attached a thin muscle, Plate I, 7, 9, & 11, C, that passing backward and downward obliquely, terminates on a broad, though thin, muscle, ib., 7, 9, & 11, OC. Within we find that the cylindrical projection terminates at the base of a double tongue-like muscle, the termination of which is free and projects well into the chamber, ib., 9, CT, where a side view is given, and ib., 8, CT, where a front view of this remarkable organ is represented. The edges of this tongue are turned upward, and in the contracted animal, the upper surface is turned backward, so that the tip rests against the upper wall of the mouth. Both the terminal portion of the tongue, on each surface, and the inside of the cylinder, are covered with a membrane that supports regular rows of numerous teeth which point backward, as given in ib., 9, D; TT, being the cylinder detached. As is evident, from the retractor muscle, ib., 7, 9, & 11, C, this whole arrangement is capable of being protruded forward so that the tip of the tongue will perhaps be brought in contact with the cutting edge of the jaw. The animals that I have examined, although living, had been fasting for over six months and thus not a vestage of food remained in the stomach, so it is difficult to judge whether the cylinder performed any of the labor of digestion; but in several instances, if not in all examined, this organ was filled with a kind of thick gelatinous substance: ib. 8, T, shows the entrance of the cylinder.

The œsophagus, see ib. 7, 8, 9, & 11, I, emerges from the top of the stomach, a little to the left, and turning downward and backward, passes between and below two sets of glands, ib., 7 & 11, P, the posterior portions of which are fastened by tissues to the muscle, ib., 7, 9, & 11, OC. These glands which have a granular appearance, evidently pour a solvent fluid into the mouth, or as I am inclined to regard it, the proventriculus, through the duct shown at ib., 7, H, The stomach is long and narrow, not being much larger than the intestine, and ends at the lower I, ib., 7. Beyond this point the intestine begins and enters the substance of the liver, which is of a greenish color and which occupies the terminal five whirls of the abdomen; the alimentary canal is now supplied with absorbents that terminate in a common duct which is apparent outside the liver, on the inner or spiral side. The intestine proceeds downward as far as the beginning of the fifth whirl of the body at a point about oppositeib., 5, AM. It then turns upward, emerging from the liver on the left side of the second whirl, ib., 5, R, passes around to the right of the back, where it becomes the rectum, ib., 6, R. and emerges at the vent, ib., 6, V.

The ventral orifice which is also the common opening to the lungs, is guarded by the flap, ib., 6, P, which interposes between it and the surface over which the animal may be moving with the foot extended. The lungs lie partly along the back and partly along the left side, ib., 6, L L.

The reproductive organs, as in all hermaphrodite Gasteropods with reciprocal impregnation, are quite complicated. They are situated on the right side near the ventral orifice, and are attached to one of the three large muscles, the upper right, ib., 11, W. The combined ovaries and testis, ib., 10, OV, enlarged still more at ib., OOV, lie on the upper surface of the liver, but do not penetrate it. Emerging from the upper extremity of this organ, is the sperm duct which is of a remarkable length, often three times as long as the shell; see ib., 10, SD; it is coiled on the back, beneath the lungs, and terminates on the central portion of the intromittent organ, ib., 10, OI, where there is also a greatly enlarged view of the posterior portion. This organ is retractile and the retractor muscle, ib., 10, IM, being attached to the tip and passing over the back, is inserted in the thicker portion of the mantle, near the foot on the left side. The organ when protruded, is flat but with the sides capable of being curved upward, forming a groove in the center.

The pyriform sperm reservoir, ib., 10, RV, which is a receptacle of the spermatozoa of another individual, lies against the combined ovaries and testis, its duct, ib., 10, D, enters the common orifice with the oviduct, ib., 10, VV. Midway between the reservoir and the orifice, or a little nearer the former named, a thin, cylindrical organ arises, and passing downward along the liver, terminates in a blind, sometimes slightly enlarged, end in the three last whirls of the abdomen; see ib., 10, M. Special mention of this organ will be made under the head of General Conclusions.

The principal muscular system may be briefly described as follows: The stomach is provided with a broad, flat muscle, which is divided into two branches, ib., 11, H, and HH, the latter named of which supports the tongue, and terminates in six fascicles ,ib.. 12, FF. This stomachic muscle is inserted on one of the two upper foot muscles, the left, ib., 11, Q; this, with its fellow, ib., 11, W, on the right. have a common origin; below them is another, ib., 11, N. All these three muscles are broad, the edges only being given in the figures, but as they pass downward they become rapidly narrower and are finally reduced to mere threads. These passing around on the inside of the liver cling to the column, and thus enable the animal to retain a given position in the shell, for it has no direct attachment to the shell. The eye peduncles and tentacles are

drawn inward by a muscle attached near the termination on the inside, as is usual with members of this family. For further special anatomical structure see Specific Characters under head of individual species, and in General Conclusions.

GENERAL HABITS.

All of the species of Strophia that I have seen living are gregarious, hundreds often occurring within a few square inches, frequently clinging together, one top of the other, sometimes three or four deep. When thus found, they are hybernating, or if in the tropics, passing the dry season in a state of inactivity, and as a rule, whenever rain falls, even although it be for a short period, they immediately begin to move. They are herbivorous, and even when inactive, remain upon the plants or shrubs on which they feed, or near them, rarely retreating beneath stones.

It is probable that the eggs are laid upon the branches of shrubs, or other similar situations, although at present I can state nothing definite regarding their breeding habits. I have never seen any very young shells of this genus, the smallest consisting of four or five whirls.

When an animal of Strophia wishes to retreat within its shell for any purpose, it withdraws itself well within the aperture, by this act, partly doubling the foot; from this doubled foot and the mouth, exude a clear, thick, glairy fluid that soon hardens when exposed to the air. By muscular contractions, the foot or surface of it, that comes in contact with the now hardening film, is undulated, thus separating it from the completely hardened and transparent wall. The foot is now withdrawn, then follows the remainder of the body, the ventral orifice, Plate I, fig. 6 v, being the last to be taken away. This occupies the lower right hand corner of the aperture and leaves a small hole. The animal now disappears, retreating as far back as the third whirl, but at about .25 from its final resting place, a second partition, (Plate II, 1, c, where the white partition may be seen in the second whirl,) is formed; the first wall is straight and, as remarked, transparent; the second is curved downward on the outer side and is nearly as opaque as rice paper which it resembles. Both walls are readily soluble in water, so that these would form no protection in case the animal fell into the water, for being air breathing, it would soon perish. The time occupied in constructing the first wall, is about three minutes. Occasionally a third wall is constructed, it being the object, evidently, of the animal to retreat within the shell as far as possible, where it remains when alarmed or during the period of hybernation.

GENERAL DISTRIBUTION.

The species of the genus Strophia appear to be centralized in the Bahamas, Cuba and adjacent islands; from these localities they are distributed outwardly in several directions, but sparingly and somewhat irregularly; thus although there are several in Hayti, there are none as far as known, in Jamaica. They are found on Porto Rico, but there are none on the Windward Islands, with the exception of a single species on Curacoa, south of Guadaloupe. One species only, as far as described, is to be found on the continent of North America, S. incana, which occurs abundantly at Key West, and possibly on some of the other keys and on the mainland. I have reasons for believing, however, that one or two other species occur on the Keys and on the extreme southern mainland of Florida. In South America, but a single species is known, S. antonio from Berbice. Thus it would appear that Strophia is almost exclusively an insular genus and I have never found them occurring far from the sea, even on small islands.

SPECIFIC CHARACTERS.

In deciding specific rank I have used the following characters, all of which are of vital importance to the life of the animals, one or another becoming more prominent under various existing circumstances: Form of shell; size; color, external and internal, whether exhibiting general tintings or markings; absence or presence of striations, their number size and regularity of form; thickness and width of margin; position and form of aperture; number of teeth, their size, length and relative position in aperture; form and size of animal and of the various internal organs when known.

Before deciding as to what characters could be made available in indicating specfic rank, I have have endeavored to thoroughly understand the range of individual variation, and to accomplish this, I have often examined with care, thousands of some species. Individual differences vary in number and kind with species, sometimes these are very great, often affecting characters that in other species remain unchanged. As will be seen, however, under head of Observations, one or more characters will be found sufficiently constant to render the species in hand recognizable. Owing to the results produced by the operations of the mysterious laws of evolution, species placed under similar conditions, even although occurring in widely divided islands, are similar, yet, although it will not be impossible for one species to occur in widely separated islands, I have never seen such a species, as I have always found some character possessed by one not found in the other.

As would naturally be expected in so plastic a genus, indications of the probable appearance of species very frequently occur. In such groups there is often strong inclination to assume certain characters, but on account of frequent gradation, through both reversion and direct hybridization, no absolutely fixed characters can be found. As all gradations occur between a group that might, at first sight, appear strongly marked enough to be considered as a sub-species, and what is most undeniably individual variation, I have not ventured to name these groups, not knowing where to draw the line, but I have always mentioned them, stating their peculiarities, The differences which now render these forms conspicuous, may increase and form a species with the individual characters prominent, or the form may revert to the original species and so become absorbed, or again, it may assume under some changing circumstances, totally different characters, acquiring a final specific form, utterly at variance from what now appears probable.

For remarks on origin of the genus, evolution of species, and relationship to allied genera, see General Conclusions.

DESCRIPTION OF SPECIES.

I. STROPHIA PANNOSA Novo.

Ragged Strophia.

Plate I, 13, animal; ib., 2, jaw.
Plate II, 1 & 1B, shell; 1C, section; 1D, young.

DESCRIPTION.

SP. CH. Size, large. Shell, robust and heavy. Strations, present but coarse. Tentacles, short, about one fifth as long as eye peduncles; teeth, two, both very long. Whirls, 12. Examined 400 specimens.

Form of shell, long oval, that is, the greatest diameter is through the second whirl; the first and third being a little smaller. Each whirl below is successively .05 smaller than the one above it, thus tapering to a blunt point, and forming an angle of about .60 degrees. There are 18 coarse, widely separated, irregularly formed striations, some of which are omitted, making the interspaces even wider. The striations are not arranged in continuous rows, and are inclined from right to left. The sutures between the whirls are not deep.

Aperture, small, contracting rapidly within, where there are two, very prominent, long teeth, the lower of which extends backward into the shell .26, and is about .05 high, while the upper makes a complete turn around the column. The position of the lower tooth is about central and the upper is elevated just above it.

The margin is not produced forward beyond the diameter of the shell but is greatly thickened, with the outer posterior portion provided with a thin, though not very prominent edge. The frontal bar is well developed, completely interrupting the striations; thus the lower wall of the aperture is smooth. Animal, large; eye peduncles, .25 long; jaw, with lower portion covered with tubercles.

Color of shell externally, white, with the apex pale purplish brown; internally, pale purplish brown, but this color does not extend beyond the teeth, fading gradually as it approaches them, so that both they and the walls beyond them are flesh color. Color of animal, pale brown, with a V-shaped mark of dark brown on the back; see Plate I, 13, upper and lower figures.

DIMENSIONS.

Size of types, 1.27 by. 57 and 1.23 by .50. Largest specimen, 1.27 by .58; smallest, 1.00 by .48. Greatest diameter, .58; smallest, 47. Longest specimen, 1.47; shortest, 1.00.

OBSERVATIONS.

There is some variation in form as well as in size, some individuals exhibiting a tendency to become shorter and proportionately wider than the type, but this character in uninjured and perfectly adult specimens is not very marked; on the other hand, at one point within the range of the species, I found a colony having nearly parallel sides; that is the three first whirls are nearly equal in diameter, and the margin is not as thick as that of the type, measuring only .08, the type being .12; an approach to this form is figured on Plate II, 1B. In color, the species is quite uniform; some are slightly flecked with brown, but this is rare, and they are oftener white to the apex. The striations are most numerous and most regular in the cylindrical form. They vary in number from 17 to 24 on the first whirl. The whirls vary from 10 to 12.

Known from all others by the large size, elongated teeth, irregular, widely separated, coarse striations, thickened margin, and white color.

DISTRIBUTION AND HABITS.

The Ragged Strophia occurs on the west end of the island of Little Cayman, living on the coarse vegetation which grows among the rocks that lie just above the beach. I have never found them east of the little cove, on the north side, called Bloody Bay, where the rocks of what is known as the Iron Shore terminate, nor east of the few houses which constitute the only settlement on the key, on the south side; thus they occupy a line, somewhat broken, of a few yards in width and about three miles long. This narrow strip was occupied by them almost exclusively, insomuch so that out of three hundred Strophias that I gathered in a two mile walk, twelve only were of another species, (S. levigata).

In habit they differ from many of the species occurring on the Caymans, in being rather solitary, at best only a dozen or so being found together, consequently they were not abundant. At the time of my visit the last week in April, the weather was mainly dry, and they were clinging to the low, stunted plants, or to rocks, and not feeding. Upon examining the basket, in which I had placed some during the day, late in the evening, I found them crawling actively, and upon being brought north, they were occasionally active until cold weather, when they all died, but for at least six months they lived entirely without food of any description.

2. STROPHIA LEVIGATA Novo.

Smooth Strophia.

Plate II, 2 & 2B, shell.

DESCRIPTION.

Sp. Ch. Size, large. Shell, robust and heavy. Striations, absent. Tentacles, about one fifth as long as eye peduncles. Teeth, two, and very long. Whirls, 11. Examined 150 specimens.

Form of shell, inclined to cylindrical, the first and second whirls being equal in diameter, and the third is but little smaller, and from this the shell tapers to quite an acute point, making an angle of .55 degrees. The striations are represented only by faintly defined lines of growth, that are, however, more prominent on the upper whirl, especially on the right side near the aperture, where there are some prominences, but these prominences are widely separated and irregular.

The aperture is small and contracts rapidly within, and the teeth are long and prominent; the central which is placed midway between the two walls, is .25 long, and the upper which is placed slightly above it, makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, but is greatly thickened, and the outer posterior portion is provided with a thin, though not very prominent, edge. The frontal bar is prominent and interrupts the striations, thus the lower wall of the aperture is smooth. Jaw, as in S. pannosa, and the animal is similar in form, but paler in color above.

Color of shell, externally, white, slightly flesh colored at extreme tip of apex; internally, pale purplish brown, but this color does not extend beyond the teeth, but fades gradually as it approaches them, so that both they and the walls beyond them are yellowish brown.

DIMENSIONS.

Size of types, 1.25 by .52 and 1.15 by .48. Largest specimen, 1.34 by .55; smallest, 1.06 by .47. Greatest diameter, .55; smallest, .46. Longest specimen, 1.34; shortest, 1.06.

OBSERVATIONS.

The cylindrical form prevails, but there is a tendency among some shells to assume a more pointed apex, and in these cases the third whirl is much smaller than the one above it, and in some instances the upper whirl is the largest. The color is nearly always uniform white, but in some specimens there is a tinging, not a flecking, of fleshy or pinkish, due to a thinning of the outer covering, evidently the result of abrasion.

The few prominences of growth that have any claim to be considered striations, are confined to the upper portion of the first whirl, usually near the aperture, but in some instances, they extend around to the left, to a point nearly opposite the margin, but in no case do they extend past this point. These are evidently reversions toward the striated form, which is probably the original species on the key, as the majority of the species here are provided with striations.

Known from all other species by the large size, absence of striations, pointed apex, long teeth, white color, and thickened margin.

DISTRIBUTION AND HABITS.

This species occurs on the west end of Little Cayman, very sparingly on the coast, and rather more commonly among the low growth of trees in the interior. They occupy an extent of country, about three miles long by a mile in width.

The habits of the Smooth Strophias are even more solitary than those of the Ragged Strophias, as they occur in isolated groups of four or five individuals, and these groups are scattered at rather wide intervals along the only two paths that cross the key anywhere; these start together on the south side but emerge about a mile apart, on the north side, near the west end. They may have occurred elsewhere in the interior, but the almost impassable character of the thick jungle, and the rough ground from which it springs, render traveling very difficult, often impossible without cutting away the shrubbery.

3. STROPHIA INTERMEDIA Novo.

Small Rough Strophia.

Plate II, 3 & 3B, shell.

DESCRIPTION.

SP. CH. Size, rather small. Shell, quite thin and not very robust. Striations, present and coarse. Tentacles, not very short, about one third as long as the eye peduncles. Examined 3,000 specimens.

Form of shell, short oval, the greatest diameter being on the second whirl, the first and third being very little smaller, and from this the shell tapers to a rather blunt point at the apex, forming an angle of about 60 degrees. There are 16 coarse, widely separated striations, some of which are omitted, and none of which form regular lines, but are somewhat inclined from right to left. The striations are wide, measuring .03, and are generally furrowed longitudinally on top, but the

edges are rounded. The sutures between the whirls are not very deep.

Aperture, rather small, but not contracted within. The central tooth is prominent and long, extending back into the shell .18, and its position is central; the upper tooth is placed just above it, and although it is not prominent, is long, and takes a turn around the column.

The margin is not produced forward quite as far as the diameter of the shell; it is not greatly thickened, measuring .06, and the posterior portion is produced backward into a thin, though not prominent edge. The frontal bar is moderately developed, and the striations are interrupted, not appearing within it. The striations on the back of the shell may be seen within the aperture, when held against the light. The animal is not very large; eye peduncles, .15 long; tentacles, .05; jaw, as in S. copia.

Color, white, with an occasional spot of purplish between the striations, and with the apex flesh color; internally, purplish brown which fades as it approaches the teeth, and does not extend beyond them; thus both they and the portions beyond them are pale flesh color. Color of animal, pale brown, with a V-shaped mark on the back, of the same color but somewhat darker.

DIMENSIONS.

Sizes of types, .90 by .40 and .88 by .40. Largest specimen, 1.04 by .44. smallest, .82 by .40. Greatest diameter, .47; smallest, .38. Longest specimen, 1.04; shortest, .82.

OBSERVATIONS.

Although the great majority of specimens of this species, are constant to the type, yet variation is very great, some specimens before me ranging from cylindrical, with the three first whirls of the same size, to those that are nearly top-shaped, having the first whirl the largest, with all gradation between. The margin varies in thickness, .12 being the extreme width. In color the tendency is to become whiter than the type, with no spottings and no fleshy tintings on the apex. The whirls are almost invariably ten but are rarely eleven. The striations vary from 16 to 19, but in all of this variation, the only decided form, is one that lives on stunted vegetation which is found in exposed situations on rocks; these are white with aheavy shell, through which the striations cannot be seen when held to the light. Some shells are not long but quite thick in diameter when compared with the type.

The Small Rough Strophia is found on the low vegetation that grows on the margin of the beach on the south side of Little Cayman,

The top-shaped form mentioned is very rare and is probably the results of an injury that the animal received, causing it to form a margin to the shell when it was not fully grown.

Distinguished from S. pannosa by the smaller size, thinner shell and margin, and more open aperture; from copia, which it resembles in size, by the smaller number of striations, 16 to 19 instead of 22 or more. The interspaces in this species are wider than the elevated striations, while in copia the reverse is the case.

Known from all other species by the rather small size, elongated teeth, irregular, widely separated, coarse striations, and white color.

DISTRIBUTION AND HABITS.

The Small Rough Strophia is found on the coast of the south side of Little Cayman, west of a large mangrove swamp that nearly divides the island into two unequal portions, and along the beach on the south side of Cayman Brac, as far east as the cocoa-nut grove extends, now about half the length of the key.

They are much more common than the Ragged Strophia, and although they mingle occasionally with the colonies of the Common Strophia that border the shore, they are never found far from the beaches. They are more common on Little Cayman than on Cayman Brac; see further remarks under habits of S. copia.

4. STROPHIA ACUTA Novo.

Pointed Strophia.

Plate II, 4 & 4B, shell.

DESCRIPTION.

Sp. Ch. Size, rather small. Shell, moderately heavy. Striations, absent. Tentacles, not very short, about one third as long as the eye peduncles. Examined 500 specimens.

Form of shell, pointed oval, the greatest diameter being at the suture between the first and second whirls, and each whirl below the second is successively .05 smaller than the one above it, and thus the shell tapers quite rapidly to the apex, forming an angle of about 46 degrees. There are only faintly defined lines of growth, that assume but little prominence even on the upper whirl; hence the shell is very smooth, and even the sutures between the whirls are very shallow.

The aperture is small but rather open, the internal diameter, just inside the margin, being a trifle more than at the entrance. The lower

tooth measures .18 in length by .05 high, is placed a little to the right of the center, and the upper placed slightly above it, is long, making a complete turn around the column, but is not very prominent.

The margin is not produced forward quite as far as the diameter of the shell and is slightly inclined backward at the top; it is not greatly thickened, measuring .05, and the posterior portion is produced back into a rather blunt and not prominent edge. The frontal bar is well developed. An interesting series of immature specimens of this species not only show that the shell is greatly thickened after it becomes nearly, or quite, fully grown, but also show that the frontal bar is not formed until the margin is completed. The animal is not very large; eye peduncles, .15 long; tentacles, .05.

Color, white, slightly tinged with purplish or bluish; internally, purplish brown which becomes paler on the lower wall of the aperture, and fades on the upper walls and teeth, into flesh color. Color of animal, very pale brown, with the back wholly brown of a darker shade.

DIMENSIONS.

Size of types, .94 by .40 and .94 by .38. Largest specimen, 1.07 by .45; smallest, .80 by .33. Greatest diameter, .45; smallest, .33. Longest specimen, 1.07; shortest, .80.

OBSERVATIONS.

The type described is constant in a very large percentage of specimens, the chief variation being in size, and this, excepting in the smallest specimen given which is an isolated example, and may even prove a distinct species, is not great. Two different forms appear; one, cylindrical and proportionately slender, having the first three whirls of the same diameter, and with the aperture inclined considerably to the right, and one wherein the form is proportionately thicker than the type, with the sutures very deep. The color is uniform, some pinkish tipping appearing which is, however, due to abrasion.

Known from all others, by the pointed apex, small size, absence of striations, long teeth, and white color.

DISTRIBUTION AND HABITS.

Under Habits and Distribution in the preceding species, I have spoken of two paths that crossed the island of Little Cayman, and these two ways formed a junction a few hundred yards from the south shore. Near this junction, the western most crossed a small open patch of ground, the borders of which were surrounded with quite low bushes. The bushes that grew on the south side of this little natural clearing,

were the stronghold of the Pointed Strophias, and I did not find them elsewhere. The border line to the north, was sharply defined at the clearing, but south, they straggled out along the higher bushes for some few hundred feet, but the entire space occupied by them, did not exceed a quarter of an acre in extent.

In habit, the Pointed Strophia is highly gregarious, hundreds occurring together in a few square yards. They appear to feed upon the foliage of the bushes, on which they were clinging, a small leaved shrub which I did not, however, find in bloom, so cannot tell to what family it belongs.

5. STROPHIA FESTIVA Novo.

Pictured Strophia.

Plate II, 5 & 5B, shell: 5C, young.

DESCRIPTION.

SP. CH. Size, large. Shell, robust and heavy. Striations, absent. Tentacles, short, about one third as long as eye peduncles. Teeth, two, both very long. Whirls, 11. Examined 22 specimens.

Form of shell, inclined to cylindrical, the first and second whirls being equal in diameter, and the third is but little smaller, and from this the shell tapers to quite an acute point, making an angle of .55 degrees. There are only faintly defined lines of growth which, however, assume more prominence on the back of the upper whirl, but these prominences are widely separated and irregular. The sutures between the whirls are not deep.

Aperture, rather small, but open, the diameter of the cavity slightly increasing just within the entrance; the teeth are prominent, the lower, which is placed midway between the two walls, is .25 long and about .05 high, and the upper which is situated just above it, measures only .03, but makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, and is not greatly thickened, measuring .08, and the outer posterior portion is provided with a thin, quite prominent, edge. The frontal bar is not very prominent.

Color of shell, externally, bluish white, marked with longitudinal spots of purplish brown, that from the third whirl downward exhibit a tendency to become fused together and form rings near the middle of the whirls. The spottings are somewhat interrupted, and are fewer on

the upper, and more numerous on the lower whirls. The frontal bar, teeth, and margin, externally and internally, are flesh color of quite a dark shade, but within the aperture this color gradually deepens into purplish brown, which pervades the whole interior.

DIMENSIONS.

Size of types, 1.20 by .50 and 1.18 by .48. Largest specimen, 1.24 by .54; smallest, .95 by .46. Greatest diameter, .54; smallest, .46. Longest specimen, 1.24; shortest, .56.

OBSERVATIONS.

The typical form given prevails but there is a tendency to a more pointed apex, with the second whirl smaller than the first; this form is figured on Plate II, 5. The margin of some specimens is very much thickened, the extreme measuring .13. In color, there is some variation in markings; although in two instances the spottings are more restricted than the type, in the majority of cases they are more extended, and in two shells the purplish brown predominates. The tendency to assume rings on the lower whirls is quite prominent, and is an unusual feature in Strophia.

Known from all others by the large size, absence of striations, long teeth and purplish markings.

DISTRIBUTION AND HABITS.

On the western path that crossed the island of Little Cayman, of which I have spoken in my account of the preceding species, about midway between the two shores, or a little nearer the northern, being thus a short half mile from the sea, were two small fields, or cultivated patches of land, containing, perhaps, a quarter of an acre each. In these limited areas I found the few specimens of the Pictured Strophias that I was able to obtain.

In habit these Strophias are one of the most solitary species that I have ever seen living, for they occur in very scattering groups on the low herbage that margins the fields; and thus limited, were not common.

6. STROPHIA PICTA Novo.

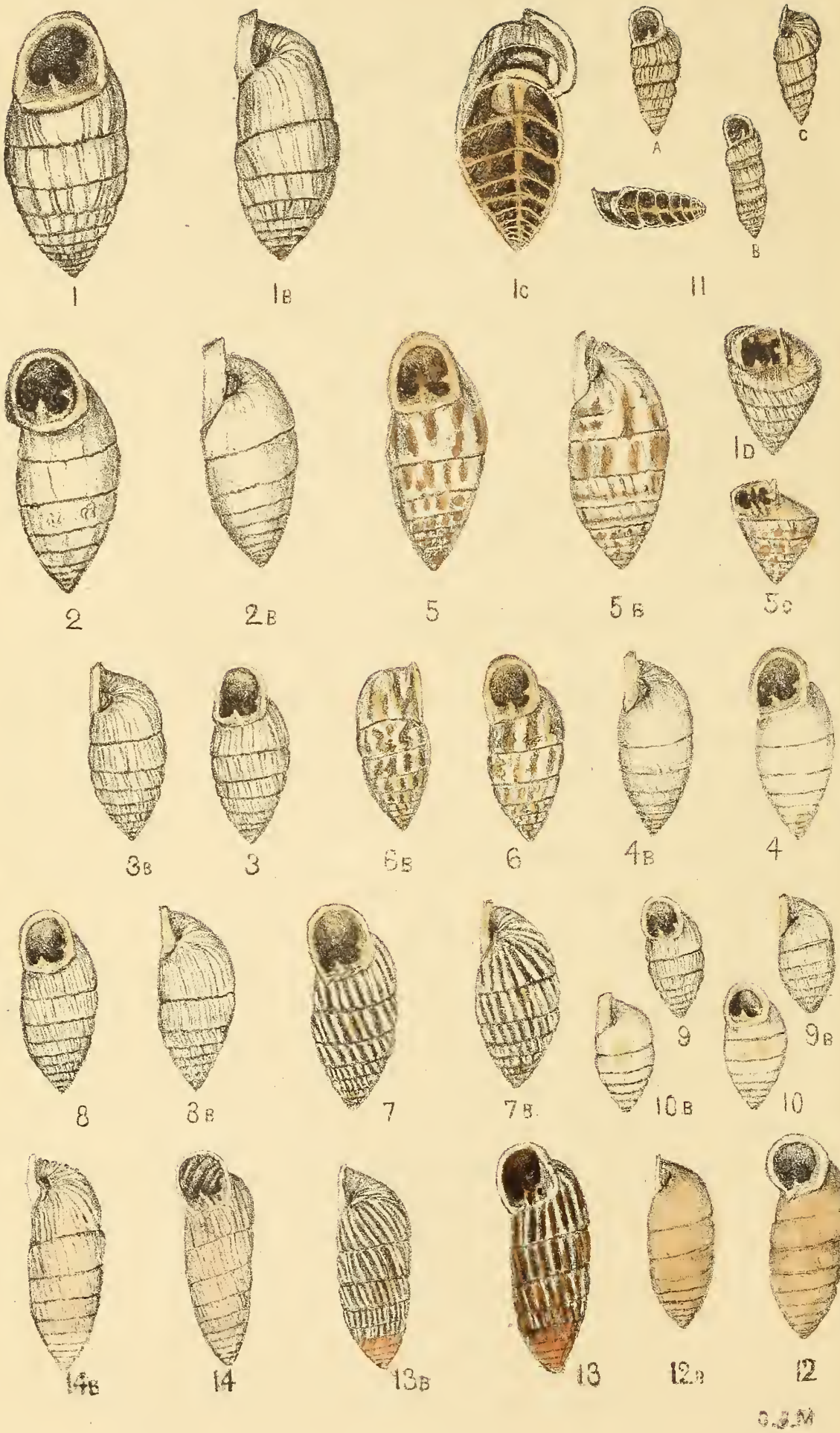
Painted Strophia.

Plate II, 6 & 6B, shell.

DESCRIPTION.

SP. CH. Size, small. Striations, absent. Whirls, 10. Teeth, two, and quite long. Examined 75 specimens. Tentacles, short.

PLATE II.


1
1B
1C
A
B
C
11
2
2B
5
5B
1D
5C
3B
3
6B
6
4B
4
8
8B
7
7B
9
9B
10B
10
14B
14
13B
13
12B
12

EXPLANATION OF FIGURES ON PLATE II.

1. Strophia pannosa, front view of type shell; 1B, left side of another individual; 1C, section and 1D, young of same species.

2. Strophia levigata, front view of type shell; 2B, left side of another individual.

3. Strophia intermedia, front view of type shell; 2B, left side of another individual.

4. Strophia acuta, front view of type shell; 4B, left side of another individual.

5. Strophia festiva, front view of type shell; 5B, left side of another individual; 5C, young of same species.

6. Strophia picta, front view of type shell; 6B, right side of another individual.

7. Strophia lineota, front view of type shell; 7B, left side of another individual.

8. Strophia copia, front view of type shell; 8B, left side of another individual.

9. Strophia parva, front view of type shell; 9B, left side of another individual.

10. Strophia glaber, front view of type shell; 10B, left side of another individual.

11. Strophia nana, A, front view of type shell; B, left side of another individual; C, front view of another form; D, section of same species.

12. Strophia nuda, front view of type shell; 12B, left side of another individual.

13. Strophia ianthina, front view of type shell; 13B, left side of another individual,

14. Strophia palida, front view of type shell; 14B, left side of another individual.

Form of shell, a pointed oval, with the second whirl the largest; the first and third are about the same size and from the third, the shell tapers to quite a blunt point, forming an angle of about 60 degrees. The lines of growth are very faintly defined, and become prominent only on the top of the first whirl. These prominences begin on a line with the frontal bar, and end at a point about half way up the margin, on the right, thus occupying the top of the whirl, ending abruptly on the line drawn, the shell below this being smooth. Sutures, not deep.

Aperture, rather small, but open, and the diameter of the cavity just within is a trifle more than at the entrance. Lower tooth, about central in position, and is .18 long by .05 high; the upper is situated just above it, is only .03 high, but makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, it is not very thick, measuring only .08, and is provided on the outer posterior portion with a rather blunt edge which unlike the majority of species, is not rolled backward. The frontal bar is not very well developed, and the lines of growth appear within it.

Color of shell externally, bluish white, marked with rather zig zag longitudinal spottings of purplish brown, that are more numerous on the lower whirls. The margin, externally and internally, and the teeth are yellowish, but this color gradually deepens within to a purplish brown, which color pervades the lower wall and whole interior.

DIMENSIONS.

Sizes of types, .96 by .40 and .86 by .39. Largest specimen, 1.04 by .41. smallest, .83 by .36. Greatest diameter, .46; smallest, .36. Longest specimen, 1.04; shortest, .83.

OBSERVATIONS.

The type is very constant and the principal departure from it, is a form that is proportionately longer and more cylindrical, but tapering from the second whirl to the apex. Individuals are shorter and with a larger diameter than the types, but scarcely constitute even a group. In color the inclination is to be redder in markings, than the types, and although a few show broader stripes, the tendency is to exhibit norrower ones, with broader areas of white. The margin is never very heavy, .10 being the extreme measurement, and the fact that the outer posterior portion is not rolled backward, is a marked feature and quite constant. The restriction of the prominent lines of growth, to the top of the first whirl is a usual, though not absolutely, constant character, it being extended in some specimens, to the lower part of the whirl, but does not extend very far back.

Known from S. festiva, its nearest ally, by the small size, more regular markings, and thinner margin, and from all others, by the absence of striations, long teeth, and purplish markings.

DISTRIBUTIONS AND HABITS.

This species occurs in a very limited area, on the west end of Little Cayman. Near the southern termination of the western path that extended across the key, or rather near its junction with the main path, was a patch of guinea-grass; in this, were numerous open spots, and in them, or on their borders, these Strophias lived, occupying in all about a half acre.

The habits of the Painted Strophias are rather more social than those of the Pictured, as they occur in small groups of a half dozen or more, but are nowhere common.

7. STROPHIA LINEOTA Novo.

Lined Strophia.

Plate II, 7 & 7B, shell.

DESCRIPTION.

Sp. Ch. The size is medium. The shell is rather heavy. The striations are present. Tentacles, about one third as long as the eye peduncles, Teeth, two and quite long. Whirls, 10. Examined 1,000 specimens.

Form of shell, cylindrical, with the first three whirls equal in diameter. From the third whirl, the shell slopes rapidly to a point, making an angle of 65 degrees. The striations are rather numerous, 20 on the upper whirl, prominent, regular, although not arranged in lines; they are slightly inclined from right to left, and the interspaces are about equal in width to the prominences. The striations are not furrowed and the edges are smooth and rounded.

Aperture, large and open, measuring a trifle more just within than at the entrance. Lower tooth, not very prominent, .04 high by .18 long, and its position is about its width to the right of the center; the upper is not as prominent, is placed considerably above it, .05, and measures .02, but makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, but is inclined slightly to the right, beyond the side; it is not greatly thickened, measuring .04, but the outer posterior portion is produced backward into a thin, but not prominent, edge that is rolled slightly

downward. The frontal bar is not well developed, and the striations appear within it, but beneath the translucent enamelling of the lower wall, and are thus not elevated. The animal is not very large; eye peduncles, .12 long; tentacles, .04.

Color of shell externally, white, with mest of the interspaces between the striations, dull purplish brown; internally, of rather a pale purplish brown which becomes paler on the lower wall of the aperture, and fades on the upper walls and teeth, into yellowish white. Color of animal, very dark brown, with the bottom of foot, eye peduncles, tentacles, and top of head in front of tentacles, horn color.

DIMENSIONS.

Size of types, 1.04 by .40 and .98 by .42. Largest specimen, 1.10 by .46; smallest, .74 by .36. Greatest diameter, .46; smallest, .36. Longest specimen, 1.10; shortest, .74.

OBSERVATIONS.

Individual variation is not great, the type form being very constant. Two forms occur besides, one of about the same ferm, but with the aperture inclined well to the right, and the shell is larger, thicker, and whiter, with fewer markings; while the other is shorter and proportionally a little thicker, with the markings in some instances, extending across the striations. The margin is never heavy, .08 being the extreme measurement. Striations vary from 18 to 20.

Known from S. copia, its nearest ally, by the prominent markings, and from all others, by these and the long teeth.

DISTRIBUTION AND HABITS.

I found the Lined Strophia in a small cocoa-nut grove on the south side of Little Cayman, near the east end, and more rarely in the cocoa-nut grove near the boat landing, on the south side of Cayman Brac, This spot on Little Cayman, about a half acre, was occupied by them exclusively, while on the other key, they mingled with the Common Strophias. They were probably transported from one place to the other by boat, the original locality, probably, being Little Cayman.

The cocoa-nut grove where I found these Strophias, was situated directly on the shore, some miles from any settlement, and was completely isolated from all other colonies of Strophias. The width of the key intervened between this point and a colony of S. copia on the north shore, two miles, at least, of nearly naked, jagged rocks, as impassable to a mollusk of this species, as would be the wide Atlantic, and there was no vegetation in this direction, to induce them to extend their

colony, and between them and the several species that occupied the west end of the island were miles of rocky country and the mangrove swamp- I found them very abundant, clinging to the fallen cocoa-nut leaves and other debris that lay upon the ground. They were gathered in close clusters of many individuals, often one top of another.

8. STROPHIA COPIA Novo.

Common Strophia.

Plate I, 1 & 3, jaw; 7, 8, 9, 10, 11, & 12, structure.
Plate II, 8 & 8B, shell.

DESCRIPTION.

SP. CH. Size, medium. Shell, rather heavy. Striations, present. Tentacles, about one third as long as eye peduncles. Teeth, two and quite long. Whirls, 10. Examined 10,000 specimens.

Form of shell, cylindrical, with the first three whirls about equal in diameter. From the third whirl, the shell slopes rapidly to a point, making an angle of 65 degrees. The striations are rather numerous, 23 on the upper whirl, prominent, and regular, although not arranged in lines; they are slightly inclined from right to left, and the interspaces are about one third as wide as the prominences. The striations are very slightly furrowed on the top, and the edges are quite smooth and rounded.

Aperture, large and open, measuring a trifle more just within than at the entrance. Lower tooth, not very prominent, .05 high by .20 long, and its position is a little more than its width to the right of the center; the upper is not as prominent, is placed considerably above it, .05, and measures .02, but makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, but is inclined slightly to the right, beyond the side; it is not greatly thickened, measuring .06, but the outer posterior portion is produced backward into a thin, but not prominent, edge that is rolled slightly downward. The frontal bar is quite prominent and interrupts the striations. Animal, not large; jaw, smooth.

Color of shell, externally, white. The frontal bar, teeth, and margin, externally and internally, are flesh color, but within the aperture this color gradually deepens into purplish brown, which pervades the whole interior. Color of animal, horn, with a V-shaped mark of brown on the back.

DIMENSIONS.

Size of types, .90 by .40 and .95 by .40. Largest specimen, 1.07 by .45; smallest, .75 by .32. Greatest diameter, .45; smallest, .46. Longest specimen, 1.07; shortest, .75.

OBSERVATIONS.

Among the large amount of shells that have passed through my hands, the typical form prevails, but there are, at least, four distinct forms in which certain characters are quite constant, but there is by far too large a percentage of gradation between them and the types, to admit giving them a name, excepting, perhaps in one instance. The first form that I shall mention, is of small size, the smallest dimensions given, but the proportions are the same, however, as the types; next comes one that is more cylindrical than the types, the third whirl being but little smaller than the those above it, and it is proportionately more slender; then we have a shorter and proportionately much thicker form in which the width is but a trifle less than one half the length; in these three forms, the whirls are 10. The fourth form is one that has occasioned me some perplexity; it is large, the largest size given, the shell is quite thick and heavy, the aperture is inclined somewhat to the right, and above all, the whirls are 11. Could I have been sure that this shell gathered in localities of its own, apart from others, I should consider that it possessed important characters enough to entitle it to a name, but I cannot remember that I found it separate anywhere, nor did I make any notes on it. In color of S. copia, there is a slight inclination to a brownish flecking.

Known from all others by the numerous striations, 22 or more, size, .75 or more long, 10 or 11 whirls, absence of any decided markings, and long teeth.

DISTRIBUTION AND HABITS.

The Common Strophia occurs on the west end of the island of Cayman Brac, and at a fishing camp on the north side of Little Cayman, also scatteringly about the houses on the west end of this key, but was probably carried to the two latter named places, by the inhabitants, the animals crawling upon their boats, or lumber, etc., and were in this manner transported.

I do not remember ever having seen any species of Land Shell, more abundant this species of Strophia. In the shrubbery that bordered the paths and roads about the west end of Cayman Brac, they were very common, clinging to the base of the bushes, in masses, but their stronghold was the cocoa-nut grove on the south shore of the key, just

opposite the few houses at the west end; here they absolutely swarmed in certain spots. Not only was the low herbage covered with them, but they fairly whitened the bases of the stems of the cocoa-nut trees, and often accumulated in such numbers on the small stumps, that they clung one top of another, often three or four deep, and could be gathered by the double handfuls. As the weather was mostly dry, they did not move much, so I could not decide upon what plant they fed, but judging from their numbers, this food plant must have been abundant, and by cultivation of the soil, the Strophias were placed under favorable circumstances for the increase of the species. Through the agency of man, three or four other species had been introduced into this large colony which occupied in all, about half a square mile of country.

9. STROPHIA PARVA Novo.

Little Strophia.

Plate II, 9 & 9B, shell.

DESCRIPTION.

SP. CH. Size, very small. Striations, present. Teeth, two, and rather long. Whirls, 9. Tentacles, quite short. Examined about 1,000 specimens.

Form of shell, nearly oval, with the second whirl the largest; the first and third are a trifle smaller and about the same size, from the third the shell tapers to quite a blunt point, forming an angle of about 60 degrees. The striations are 18 on the first whirl, are quite prominent, slightly furrowed, but with the edges rounded; the interspaces are narrower than the prominences. Sutures, rather deep.

Aperture, not very small, but open, and the diameter of the cavity just within is a trifle more than at the entrance. Lower tooth, placed a little to the right of the center, and is .16 long by .05 high; the upper is situated just above it, is only .02 high, but makes a complete turn around the column.

The margin is not produced forward quite as far as the diameter of the shell, it is not thick, measuring only .06, and is provided on the outer posterior portion with a rather blunt edge which is slightly rolled backward. The frontal bar is quite well developed, and the striations do not appear within it.

Color of shell externally, dull white, with an occasional patch of purplish yellow which is due to a wearing away of the outer surface through abrasion. The margin, externally and internally, and the teeth are yel-

lowish, but this color gradually deepens within to a purplish yellow which color pervades the whole interior.

DIMENSIONS.

Sizes of types, .60 by .30 and .63 by .32. Largest specimen, .72 by .32; smallest, .60 by .30. Greatest diameter, .37; smallest, .27. Longest specimen, .72; shortest, .68.

OBSERVATIONS.

The type is very constant and the principal departure from it, is a form that is proportionately longer and more cylindrical, but tapering from the second whirl to the apex. Individuals are shorter and with a larger diameter than the types, with from 20 to 24 whirls and may constitute a group. In color there is an inclination to show fleckings and to increase the worn patches. The margin, as a rule, is not heavy, but now and then this is thickened, .10 being the extreme.

Known from all other species, by the presence of striations, small size, less than .73 long, and long teeth.

DISTRIBUTION AND HABITS.

This species occurs in a very limited area, on the west end of Cayman Brac. Near the northern termination of a path that crosses the key near the western end, is a strip of quite high shrubbery, and in this these Strophias lived. From this point, they were scattered at intervals, quite into the large colony of Common Strophias, in the cocoa-nut grove on the south side, having evidently been inadvertently transported by the inhabitants.

In habit these Strophias are decidedly social occurring in groups of a dozen or more, clinging to the branches of the shrubbery, often at a considerable distance from the ground, sometimes five or six feet, differing in this respect, from any other species that I have seen living, it not being usual for them to ascend more than one half of this distance.

10. STROPHIA GLABER Novo.

Little Smooth Strophia.

Plate II, 10 & 10B, shell:

DESCRIPTION.

SP. CH. Size, very small. Shell, rather heavy. Striations, absent. Teeth, two, both long. Whirls, 9. Examined 16 specimens.

Form of shell, oval, the greatest diameter being at the second whirl, the first and third are but little smaller, and from this last the shell

tapers to a blunt point, making an angle of 60 degrees. There are only faintly defined lines of growth which, however, assume more prominence on the back of the upper whirl, but these prominences are widely separated and irregular. The sutures between the whirls are not very deep.

Aperture,rather small, but open, the diameter of the cavity slightly increasing just within the entrance; the lower tooth is placed midway between the two walls, is .16 long and .08 high, and the upper which is situated just above it, measures only .02, but makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, and is somewhat thickened, measuring .08, and the outer posterior portion is provided with a blunt and not prominent edge which is not curved downward. The frontal bar is quite prominent.

Color of shell externally, bluish white marked with abraded patches of purplish yellow. The frontal bar, teeth, and margin, externally and internally, are yellowish, but within the aperture, this color gradually deepens into yellowish purple which pervades the whole interior.

DIMENSIONS.

Size of types, .62 by .33 and .65 by .30. Maximum size, .88 by .34; minimum, .61 by. 32. Greatest diameter, .37; shortest, .30. Longest, .88; shortest, .61.

OBSERVATIONS.

This species bears the same relation to S. parva that S. perplexa does to copia, and though I have seen but comparatively few specimens, I cannot consistently do anything else but name it. There is a tendency to assume both a cylindrical and a short, thick form. As in S. perplexa, there are scattering prominences on many of the whirls of some specimens, but they are not conspicuous enough, nor uniform enough to be considered striations.

Known from all other species by the absence of striations, small size, and long teeth.

DISTRIBUTION AND HABITS.

This species of Strophia occurs on the west end of Cayman Brac, near the northern terminus of the path that crosses the key near the houses.

I found this species very rare on the margin of the path near the area occupied by S. parva. They were rather solitary in habit, and occurred on the low herbage which offered them an opportunity for concealment.

II. STROPHIA NANA Novo.

Dwarf Strophia.

Plate II, 11, A, B, & C, shell; D, section.

DESCRIPTION.

SP. CH. Size, exceedingly small. Shell, moderately heavy. Striations, present. Tentacles, short, about one fourth as long as the eye peduncles. Whirls, 11. Teeth, long. Examined 2,000 specimens.

Form of shell, an elongated cone, with the first whirl the largest; the next three are successively a trifle smaller, then the shell slopes rapidly to a point, making an angle of about 60 degrees. The striations are 18 on the upper whirl, prominent, and excepting on the first whirl, where they are narrower above and enlarged in the middle, are largest at the top, and gradually become narrower, attaining the minimum near the suture, where both they and the shell are depressed below the diameter; from this point to the suture the striations become suddenly enlarged and widened as much as at the beginning above, and are slightly inclined to the left. The striations are not arranged in lines, and are slightly inclined from right to left; the interspaces are a trifle wider than the prominences which are roof-shaped, with the ridge somewhat rounded, and the surface is smooth. The striations are absent on the two or three lowest whirls. The sutures between the whirls are not very deep.

Aperture, large and open, but does not measure any more within than at the entrance. Lower tooth, not very prominent, is .10 long and .02 high, and the upper which is situated just above it, is not at all prominent, being a mere elevation, but more within the cavity is higher, and makes a complete turn around the column.

Margin, not produced forward quite as far as the diameter of the shell, and is inclined slightly backward; it is not thickened, and the outer portion is produced into a thin, but not prominent, edge that is not rolled downward. The frontal bar is quite prominent and interrupts the striations. Animal, not large; eye peduncles, .20 long; tentacles, .05. Jaw, smooth.

Color of shell, externally, dull ashy. The frontal bar, teeth, and margin, internally, are bluish white, but within the aperture this color gradually deepens into pale purplish brown which pervades the whole interior. Color of animal, pale brown, with the minute granulations on the anterior portion of body and head, black.

DIMENSIONS.

Size of types, .62 by .25 and .60 by .18. Largest specimen, 64 by .26; smallest, .53 by .20. Greatest diameter, .28; smallest, .18. Longest specimen, .64; shortest, .53.

OBSERVATIONS.

The type as described and figured on Plate II, 11, A, is the most prevalent, but a more cylindrical form is very common, ib., B, in which there is but very little difference either in diameter or width between the second, third, and fourth whirls, the first being wider, but not much larger in diameter. The specimen figured has the striations far from prominent, but this one is almost, if not wholly, unique in this respect. The remaining form is shorter than the type, but has about the same proportions. The depressed line above the suture, and the inclined enlargment of the base of the striations are some of the singular features of this most remarkable Strophia, and remind one of a similar structure in the genus Chondropoma. The peculiar ashy colors may be partly due to minute, dark. apparently eroded dots, with which the shells are covered. Striations vary from 16 to 20; whirls, 10 or 11.

Known from all other species, by the presence of striations, exceedingly small size, elongated form, and long teeth.

DISTRIBUTION AND HABITS.

"The island of Little Cayman is only ten miles long with an average width of two miles, and is thus a mere spot in the waters of the Caribbean Sea, and the Dwarf Strophias occur in a space which is only five or six yards wide by twenty long, on this little key, and as they were rigidly confined to this narrow area, which on a good sized chart of the West Indies, would be more than covered by the point of a fine cambric needle, I consider that this species has the most restricted range of any animal with which I am acquainted." This spot is on the west end of Little Cayman, on the eastern most of the two paths that cross the key, near their junction.

In habit, this species is social, and I found many of them clinging to a kind of heath-like plant which was about eighteen inches high, and which had small gray leaves of nearly the same color as the shells, and which on being crushed, gave out a strong odor. Here these Strophias were exposed to the burning rays of a nearly vertical sun, and the heat in which they lived during the day, was intense. Some, perhaps one third of them, had retreated beneath stones, a situation in which it is rare to find a Strophia, the only other species that I have found in a similar situation, being S. incana from Key West, which retreated from the

cold of winter, and one other species occurring in the pine woods on the island of New Providence, to be mentioned later.

It is evident that in this species, we have a Strophia dwarfed to an exteme degree, from feeding on the pungent leaves of the plant described, and isolated as it is by surrounding areas of rough, jagged rocks, the process of diminution has gone as far as it can go and allow the animal to live as a Strophia, with the ordinary habits of Strophia. The ground was strewed with thousands of dead shells, showing that mortality among them was great, and the, perhaps, recently acquired habits of seeking the shelter of rocks is one to which they are driven in order to preserve the species from utter extermination, but it is doubtful whether they will even keep their generic characters under this new mode of existence, For further remarks upon this very interesting subject consult General Conclusions.

12. STROPHIA NUDA Novo.

Naked Strophia.

Plate II, 12 & 12B, shell.

DESCRIPTION.

SP. CH. Size, medium. Shell, thin. Teeth, two, short. Striations, absent. Examined three specimens. Whirls, 10 & 11.

Form of shell, cylindrical, the first four whirls being about equal in diameter; then the shell curves to a blunt point, making an angle of 65 degrees. There are only faintly defined lines of growth which are more prominent on the upper whirl. Sutures, deep, with whirls bulging.

Aperture, large and open. Lower tooth, placed to right of center, is not prominent, and is .10 long by .03 high; the upper is a mere elevation at the entrance, is larger within, but is short.

Margin, not produced forward quite as far as the diameter of shell, and is inclined slightly to the right; it is thin. Frontal bar, not large.

Color of shell externally and internally, dark flesh, yellowish at apex, and fading to nearly white on margin and teeth. Shell, polished.

DIMENSIONS.

Size of types, 1.00 by .39 and .82 by .32; other specimen, .89 by .38.

OBSERVATIONS.

Although I have only three of this singular Strophia which I found near Clarence Harbor, Long Island, Bahamas, I have ventured to name it, as I have never seen anything like it. Known at once by the cylindrical form, bulging whirls, short teeth, and naked, flesh colored shell.

(CONTINUED.)

DESCRIPTION OF AN APPARENTLY NEW SPECIES OF WARBLER FROM JAMAICA.

The following is a brief description of a Warbler that I found while looking over a collection of bird skins in the museum of the Institute of Jamaica, at Kingston, where permission was kindly given me to name it by the curator, Prof. J. J. Bowery.

DENDRŒCA IGNOTA Novo.

Jamaica Palm Warbler.

Plate, III, 1, head.

DESCRIPTION.

Sp. Ch. Size, moderate, about that of Dendrœca palmarum, to which it bears a general resemblance.

Color. Top of head, dark chestnut, with an indication of a central stripe. Back and sides of head, ashy, tinged with greenish on rump. Wings, brown, with the edges of the feathers lighter. Throat and superciliary stripe, sulphur yellow. Narrow line through cheeks and maxillary stripe, chestnut as in the crown. Remaining under portions, paler yellow than the throat, with narrow stripes of dusky across the breast; abdomen, lighter, but the under tail coverts are yellow. Tail, dark brown, having the two outer feathers spotted with white, terminally.

OBSERVATIONS.

The nearest ally to this species, is D. palmarum, from which it differs in the purer colors beneath, absence of streakings on the sides, and presence of the two stripes on the sides of the head; it is true that in the Yellow Redpoll there is an indication of a maxillary stripe of chestnut in some specimens, but I have never seen it as extended as in this new species. But even if this stripe were common to both birds the other characters given would be sufficient to separate them. There are no other species of Warblers with which Dendrœca ignota can be confounded.

The specimen described, the only one in the collection, was labeled "Hamstead, St. Andrews, April 4th.,-79. J. Goodlet." The type remains in the museum at Kingston.

Bittern emits at times, upon rising when disturbed. The sterno tracheal muscle, Figs. 2, 4, 5, 6, s and Fig. 3, k, that acts as a retractor for the vibrating, or tympaniform, membrane, is not particularly well developed. The tympaniform membrane, Figs. 2 and 5, o, although broad, is thick and incapable of much vibration, and finally, the bones which make up the body of the larynx, Fig. 2, e, and Fig. 4, i, are short and on the sides, are fused together as seen in Fig. 5, a. I have given figures of the lower larynx, to show a peculiar modification for preventing too great pressure against the inside of the bronchial tubes, by the distended lower portion of the gullet which passes between them. Although the air is cut off, in a great measure, from this portion, by the scapular attachment of the large compressing muscle, Fig. 3, t, yet there must be considerable inflation of this part. As seen in Fig. 4, a a, the bronchial tubes are considerably widened, even on the upper side, and below, their width is no less. On the under side of each tube, there is a swollen portion made up of a hard, rather fibrous substance. This is the portion colored pink in Figs. 2 and 6. This elevated portion comes in contact with the gullet and prevents it from pressing against the tympaniform membrane. Fig. 2 shows the lower side of the larynx, 4 the upper side, 6 is the inside of the left bronchial tube, the right side being removed at this junction with the trachea, e. Fig. 5 shows the outside of the same tube. All the figures are the size of life. Other references not given, are as follows: m, trachea; t, beginning of slight bronchial muscle, best seen in Fig. 5, between m and a; c, bronchial tubes; and n, position of lungs.

SUMMARY.

I give below a summary of the various modifications that the organs of the American Bittern have undergone in order to produce the pumping notes. I do not wish to be understood to say, that the different muscles given are positively new to science, but that the functions to which they are here applied, have never been noticed, and that they have become so modified in order to perform these functions, as to warrant the applications which I have given them. I have never noticed anything of the kind among other Herons, and a pair of Least Bitterns, Ardetta exilis, taken at Wayland, June 10th of this year, did not, upon careful examination, show even a rudiment of the peculiar vocal muscles, and they were about to breed.

1. The œsophagul, enveloping muscles assume peculiar characters for the breeding season. They weighed, with the skin, six ounces. May be present in other species, for the purpose of shaking the skin of the

neck; for example, the constrictor colli of Owen, seen in the Apteryx, may be something similar.

2. The scapular prolongation of the œsophagul muscle has an analogy to the muscle that assists to empty the crop in Pigeons and in some other birds, but they have a different attachment; viz. to the inside of the coracoid bones.

3. The occipital vocal. I have never seen described anything just like this muscle, neither have I found it in other birds. A Cochinchina fowl had a flat muscle starting below the ear and just in front of it, and extending back some two inches, to be inserted on the skin of the neck, its use evidently being to raise the feathers of the neck.

4. The maxillary vocal; I have never seen anything like this muscle.

5. The thoracic is a most peculiar muscle at this time, being surcharged with blood and evidently temporarily greatly enlarged.

6. The mandibular vocal are also singular muscles, surcharged with blood and evidently enlarged for the occasion. I am under the impression that I have seen these muscles either in this species before or in some other Heron, but I do not appear to have made a note of it.

7. The retractor to the superior larynx is not present in the Least Bittern, nor in most birds; I found it, however in a Cochinchina fowl, but in this case it extended to the body, and was attached to the lower portion of the termination of the furcula.

The inferior laryngeal modifications and the bubbles in the tissue to prevent undue pressure, the one on the neck and the other on the bronchials, together with the crop-supporting tendons of the neck, appear to be common modifications, arising with requisite circumstances.

MONOGRAPH OF THE GENUS STROPHIA.

(CONTINUED FROM PAGE 29.)

Since writing the first part of this monograph I have seen additional collections, and must say, that I am more than ever impressed with the fact that the genus Strophia needs a thorough revision. I am impelled to form this opinion after noting the doubtful manner in which some collections are labelled. Not only are the most obviously different species, from widely different localities, labelled with the same name, but many names are supplemented with a "?", or with "var.?"!

13. STROPHIA IANTHINA Novo.

Violaceous Strophia.

Plate II, 13 & 13A, shell.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, rather heavy and elongated, the width being about one third the length. Striations, present. Teeth, two, both short and not prominent. Whirls, 11. Examined 300 specimens.

Form of shell, cylindrical, the first three whirls being nearly equal in diameter and occupy more than two thirds of the length of the shell. The fourth whirl is but slightly smaller and from this, the shell tapers to a blunt point, forming an angle of 65 degrees. The striations are numerous, 24 on the upper whirl; they are prominent, very regular, and arranged in lines which are quite straight, being very little inclined from right to left; and the interspaces are little wider than the prominences. The striations are not furrowed and the edges are smooth and rounded.

Aperture, very large and open, measuring considerably more just within than at the entrance. Lower tooth very small, .02 high and .08 long, placed about in the centre, and the upper tooth is but a mere rudiment.

Margin, not produced forward beyond the diameter of the shell, slightly inclined to the right, is thin, with the edge rolled well back, about once the thickness of the margin. The frontal bar is well developed and the striations appear within elevated.

Color of shell externally, deep violaceous purple, gradually becoming reddish orange toward the apex which is nearly white. The margin, frontal bar and striations are white, the latter somewhat encroached upon, especially above, by violaceous. Internally, very deep, rich purplish brown.

DIMENSIONS.

Size of types; 1.15 by .37 and 1.00 by .36. Largest specimen, 1.15 by .42; smallest, .85 by .30. Greatest diameter, .42, smallest, .30. Longest specimen, 1.15; shortest, .85.

OBSERVATIONS.

The type form prevails but there is a tendency toward a smaller form with finer striations, but these specimens are possibly only reversions toward some of the several finely striated species that occur on Inagua. Distinguished at once from all others, by the deep purplish

color of the aperture, the violaceous externally, and the rather widely separated, prominent, white striations.

DISTRIBUTION AND HABITS.

I found this very handsome Strophia on the scattering shrubbery that grows on the rocky plains between the elevations that skirt the southern shore of Inagua, and the extensive salt lake of the interior, about twenty-five miles from Mathewstown.

This was during the very dry month of February, and they were fastened to the stems of trees and bushes. I think their range is somewhat further extended on this shore, but how far I cannot, at present, state.

14. STROPHIA PALLIDA Novo.

Pallid Strophia.

Plate II, 14 & 14A, shell.

DESCRIPTION.

SP. CH. Size, medium. Shell, thin. Striations, present. The whirls are 11. The teeth are two, and very short. Examined 25 specimens.

Form, a pointed cylinder, the first whirl measuring most in diameter and each of the next four is less in size, then the remainder taper to a short point, forming an angle of about 60 degrees. The striations are not numerous, 14 on the first whirl, rather regular, but not arranged in lines; they are slightly inclined from right to left, and the interspaces are one third wider than the prominences. The striations are not furrowed and the edges are rounded.

Aperture, very large and open and the walls within it are so thin that the striations can be seen through them. Lower tooth, not prominent, .03 high by .08 long, and its position is a little to the right of the centre; the upper is placed high and is not prominent

Margin, not produced forward beyond the diameter of the shell, is straight, very thin, with the edges slightly rolled backward. The frontal bar is moderately well developed and the elevated striations appear within it.

Color of shell, externally, flesh color, deepening to pale purple on the two upper whirls; margin, striations, and apex, white; internally, pale purplish.

DIMENSIONS.

Size of types, 1.03 by .36 and 1.03 by .33. Largest specimen, 1.07 by .40; smallest, .85 by .33. Greatest diameter, .41; smallest, .32. Longest specimen, 1.07; shortest, .85.

OBSERVATIONS.

There is a slight inclination to assume a cylindrical form but the pointed specimens are the most common.

Known by the coarse striations, thin shell, pointed form, and pale ground colors, with the white striations and margin.

DISTRIBUTION AND HABITS.

The Pallid Strophias occur on the island of Inagua in the cultivated fields that lie on the slopes of the hills that border the southern shores, between fifteen and twenty miles from Mathewstown, and possibly elsewhere on the island.

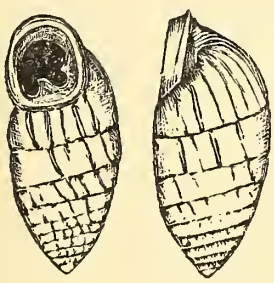
15. STROPHIA PERPLEXA Novo.

Ridged Strophia.

Plate VII, 15 & 15A, shell. and Fig. 7, A left side, B front.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thick and rather heavy. Striations, assume the form of irregular ridges. Whirls, 11. Examined 300 specimens.



B A

Fig. 7

Form of shell, inclined to cylindrical, the first two whirls being equal in diameter and the third is but little smaller. From the third whirl, the shell slopes rapidly to a rather blunt point, making an angle of about 60 degrees. The striations are represented by irregular, slightly elevated ridges, that are rather more prominent on the upper portion of the shell. Some of the ridges are a little flattened on the top and furrowed.

Aperture, rather small and narrows within. Lower tooth, prominent, .05 high, .24 long, and its position is just a little to the right of the centre; the upper is not as prominent but measures .05 and makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, is not inclined to either side, is considerably thickened, measuring .06,

and the outer posterior portion is slightly produced backward, but there is no prominent edge. The frontal bar is well developed and the striations do not appear within it.

Color of shell, externally, white; internally, pale purplish brown which gradually fades into yellowish white on the teeth and walls within the aperture.

DIMENSIONS.

Size of type, .90 by .40. Largest specimen, 1.00 by .43; smallest, .78 by .34. Greatest diameter, .43; smallest, .34. Longest specimen, 1.07; shortest, .85.

OBSERVATIONS.

While a large percentage of the specimens of this species clesely resemble the type, there is a tendency to assume a more pointed form with a less number of ridges, thus bearing a somewhat close resemblance to S. acuta, but I have never seen a S. perplexa that could not be separated from that species by the presence of more or less ridges, and by the greater thickness of the shell and its whiter color. On the other hand, some specimens exhibit an inclination to assume striations, irregular and widely separated, thus approaching S. intermedia, but the striations are never decided enough for intermedia. In possessing these characters, however, the Ridged Strophia is between the Pointed and Intermediate Strophias, and at first occasioned me considerable perplexity, as it appeared to form a connecting link between the two. But as S. perplexa occurs on Cayman Brac, apart from other Strophias, and is thus widely separated from either of the two closely allied shells, and like many species having apparently obscure characters, taken individually, yet while in mass, show strong differences, I soon saw that I could not consistently do otherwise than to consider it a distinct species, as above described.

Known from all other species, by the absence of striations but presence of ridges, white color, and heavy shell.

DISTRIBUTION AND HABITS.

The Ridged Strophias occur on the island of Cayman Brac in a barren, rocky section, about two miles from the west end of the key, and a quarter of a mile from the south shore. They were restricted to a very limited area, and I found them clinging to low herbage or to the naked rock, in almost every instance, exposed to the burning rays of a tropical sun.

16. STROPHIA NITELA Novo.

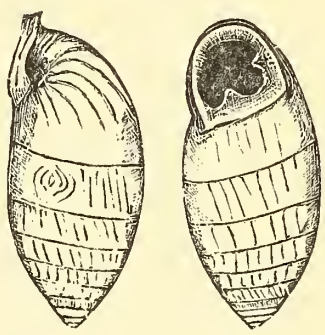
Shining Strophia.

Plate VII, 16 & 16A, shell. and Fig. 8, A, front B, left side,.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thick and rather heavy. Striations, absent. Teeth, two, and very long. Whirls, 11. Examined 300 specimens.

Form of shell, a rather pointed oval, the first whirl is, however, the largest in diameter, the second is a little smaller, and each of the remainder is considerably less in size, thus the shell slopes rapidly to a rather blunt point, making an angle of about 55 degrees. There are only faintly defined lines of growth that assume more prominence on the back of the upper whirl. Sutures, not deep.



B A

FIG. 8.

Aperture, large, open, measuring a little more just within than at the entrance. The lower tooth is prominent, .05 high, .24 long, and its position is just a little to the right of the center; the upper is not as prominent but measures about .04, and makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, nor inclined to either side, is not greatly thickened, measuring .06, and the outer posterior portion is provided with a thin, not prominent edge. The frontal bar is well developed.

Color of shell, externally, shining white; internally, purplish brown, which gradually fades into yellowish on the teeth and margin.

DIMENSIONS.

Size of type; 1.10 by .50. Largest specimen, 1.12 by .54; smallest, 1.00 by .44. Greatest diameter, .52; smallest, .44. Longest specimen, 1.12; shortest, .44.

OBSERVATIONS.

This species is very uniform in size and form, but some specimens show a tendency to become more obtuse.

Known from the allied S. acuta by the larger size and more obtuse form, and from S. levigata by the smaller size and smooth surface. From all others by the long teeth and absence of striations.

DISTRIBUTION AND HABITS.

The Shining Strophias occurred in numbers, in exposed situations in the patches of Guinea grass that grew on the margin of the path, of which I have spoken elsewhere, that crosses the west end of Little Cayman. They were clinging to the stems of the grass, at the roots of which lay hundreds of dead specimens. They appeared to be restricted to two or three of these small clearings.

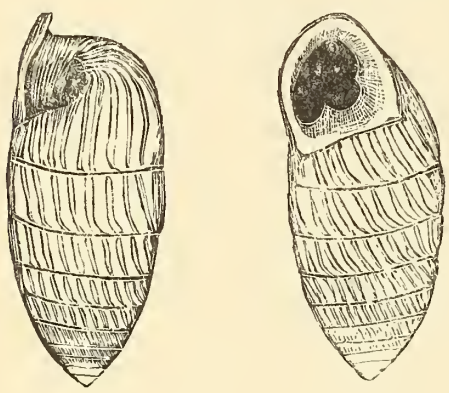
17. STROPHIA ALBA Novo.

White Strophia.

Plate VII, 17, 17A & 17B, shell; Fig. 9, A, front, B, side; Fig. 11, section.

DESCRIPTION.

SP. CH. Size, large. Shell, not very heavy. Striations, present. Teeth, two, both short and not prominent. Whirls, 11. Examined 250 specimens.



B A

FIG 9.

Form of shell, cylindrical, with the first two whirls equal in diameter and the third is slightly smaller; from this, the shell tapers to a blunt point, forming an angle of 65 degrees. The striations are numerous, 24 on the first whirl; they are prominent, regular, but are not arranged in lines, are inclined from the right to the left; and the interspaces are about as wide as the prominences. The striations are flattened on top but are not furrowed and the edges are smooth and rounded.

Aperture, very large and open, measuring more just within than at the entrance. Lower tooth not prominent, .03 high by .12 long, and its position is about central; upper tooth, a mere protuberance.

Margin, not produced forward beyond the diameter of the shell, and is slightly inclined to the right, beyond the side; it is thin, measuring only .03; and the edges are slightly rolled backward. Frontal bar, not well developed but the striations do not appear within it.

Color of shell, externally, bleached white throughout; internally, pale brownish purple, fading into flesh color on the teeth and margin.

DIMENSIONS.

Size of type, 1.42 by .55. Largest specimen, 1.27 by .58; smallest. 1.12 by .50. Greatest diameter, .50: smallest, .48. Longest specimen, 1.42; shortest, 1.12.

OBSERVATIONS.

This is a very uniform species, specimens varying very little from the type. I am not the first, by any means, to collect this species, as I have seen it in collections, but always labelled with the name of some other species, though why, I cannot well imagine, as it is one of the most strongly defined species found on the Bahamas.

This species well represents the short toothed form of Strophia prevalent on the Bahamas and in some portions of Cuba; see Fig. 10, where I have given a section of S. alba, showing short tooth, and compare with Plate II, 1B, where is given a section of S. pannosa, one of the long toothed species.

Known by the large size, open aperture, short tooth, white color, prominent striations, and form as given.

FIG. 10.

DISTRIBUTION AND HABITS.

I found the White Strophia common on the west coast of Rum Key, near the salt pond, on the low shrubbery between it and the beach, frequently quite near the sand. At this time they were quiet, as the weather was dry.

18. STROPHIA LENTIGINOSA Novo.

Flecked Strophia.

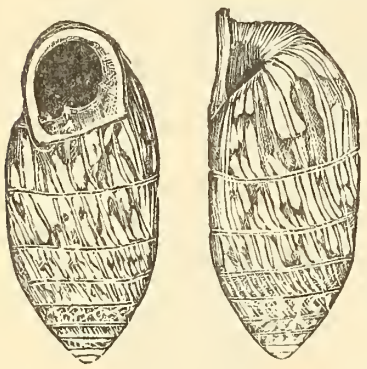
Plate VII, 18 & 18A, shell; Fig. 11; A, front, B, left side.

DESCRIPTION.

SP. CH. Size, large. Shell, not very heavy. Striations, present. Teeth, two and short. Whirls, 11. Examined 150 specmens.

Form of shell, rather cylindrical, with the first two whirls equal in diameter, and the third is but little smaller; from this, the shell slopes to an obtuse point, forming an angle of 65 degrees. The striations are numerous, 25 on the upper whirl, prominent, regular, but not arranged in lines, and the interspaces are not as wide as the prominences. The striations are rounded but not furrowed.

Aperture, large and open, measuring a trifle more just within than at the entrance. Lower tooth, not very prominent, .03 high by .12 long, and its position is just a little to the right of the center; the upper is placed well above it but is a mere protuberance, yet this slight elevation makes a complete turn around the column.



A B

FIG 11.

Margin, not produced beyond the diameter of the shell, is not inclined to the right, is very thin, measuring .03, but the edge is not rolled backward. The frontal bar is not well developed and is smooth within.

Color of shell, externally, white, conspicuously spotted and flecked with very irregularly formed markings of purplish; internally, purplish brown which gradually fades into flesh color on the teeth and margin.

DIMENSIONS.

Size of types, 1.23 by .54. Largest specimen, 1.40 by .56; smallest, 1.10 by .48. Greatest diameter, .56; smallest, .48. Longest specimen, 1.40, shortest, 1.10.

OBSERVATIONS.

There is considerable variation in respect to color and extent of markings, some are darker than the type and some are paler; in the type, the colored portions are about equal to the white, but in some cases, the purplish predominates, and in some, especially in paler colored specimens, the spottings are comparatively few and consequently the white is in excess. The aperture is also inclined considerably to the right in some shells.

As a rule, however, the species is quite uniform in form and markings.

Known from all others, by the large size, prominent striations, open and thin-margined aperture, and conspicuous markings.

DISTRIBUTION AND HABITS.

The Flecked Strophias occur in the interior of Rum Key, where they are not very common, living in isolated groups in rather exposed situations, but among foliage and plants. The specimens collected were obtained on the western side of the island but I am, at present, unable to give the exact range of this and the preceding species, yet should judge that the habitat of both is comparatively extended.

19. STROPHIA FUSCA Novo.

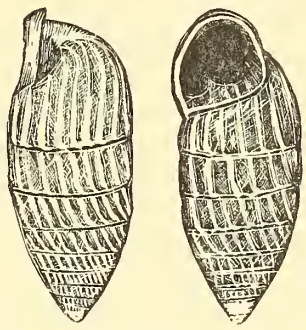
Brown Strophia.

Plate VII, 19 & 19A, shell; Fig. 12; A, front, B, left side.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, not very heavy. Striations, present. Teeth, two and long. Whirls, 11. Examined 46 specimens.

Form of shell, a pointed cylinder with the first whirl the largest in diameter, and the next two are successively smaller; thus the shell tapers to a rather acute point, making an angle of about 50 degrees The striations are not numerous, 17 on the upper whirl, quite prominent, not regular, nor arranged in lines, and the interspaces are about twice as wide as the prominences. The striations are rounded and slightly furrowed.



B A

FIG. 12.

Aperture, small, but measures a trifle more just within than at the entrance. Lower tooth, prominent, .05 high by .25 long, and its position is just a little to the right of the center; the upper is placed well above it but is not as prominent, yet makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, is slightly inclined to the right, is rather thick measuring. 06, and the outer posterior portion is provided with a thin, not prominent edge. The frontal bar is not well developed and is smooth within.

Color of shell externally, brown, paler at the apex, and with the striations white; internally, pale brown which gradually fades into flesh color on the teeth and margin.

DIMENSIONS.

Size of type, 1.25 by .45. Largest specimen, 1.35 by 55; smallest, .90 by .42. Greatest diameter, 1.35; smallest, .42. Longest specimen, 1.35; shortest, .90.

OBSERVATIONS.

There is considerable variation in this singular Strophia in respect to size, as shown, and specimens are inclined to be shorter and more obtuse, in proportion to the size, and more cylindrical. Some show a thicker margin.

Known from all other species, by the brown color with contrasting, wide apart, white striations, and long teeth.

DISTRIBUTION AND HABITS.

The Brown Strophias occur on the west end of Little Cayman, low down in the thick scrub. They are quite solitary in habit, and rather rare, but it is probable that they range through the higher growth of woodland of this section, at least as far east as the mangrove swamp of which I have spoken.

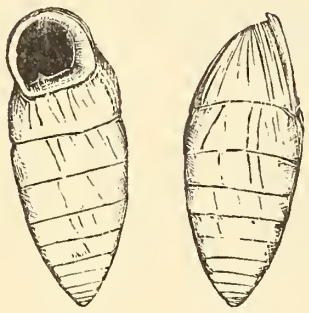
20. STROPHIA INCANA Binney.

Gray Strophia.

Plate VII, 20 & 20A, shell: Fig. 13, A, front, B, right side;
Pupa incana Binney, Terr. Moll. N. A., I p. 109; III, 1851.

DESCRIPTION.

Sp. Ch. Size, small. Shell, thin. Striations, absent. Teeth, two, both short and not prominent. Whirls, 11. Examined 1,000 specimens.



A B

Fig 13.

Form of shell, cylindrical, with the first two whirls equal in diameter and the third is slightly smaller and the fourth is a little less in size, from this, the shell tapers to a blunt point, forming an angle of 65 degrees. The lines of growth are only faintly defined, but assume more prominence on the back of the upper whirl. Sutures, not deep.

Aperture, large, open, measuring a little more just within than at the entrance. The lower tooth is not prominent, .02 high by .08 long, and its position is just a little to the right of the center; the upper is a mere protuberance, yet makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, nor is inclined to either side, is very thin, measuring only .02, and the edges are slightly rolled backward. Frontal bar, not well developed.

Color of shell, externally, grayish white throughout; internally, yellowish white.

DIMENSIONS.

Size of type; 1.05 by .40. Largest specimen, 1.07 by .67; smallest, .67 by .35. Greatest diameter, .41; smallest, .30. Longest specimen, 1.05; shortest, .67.

OBSERVATIONS.

As shown under Dimensions, there is great variation in size, in this species. This extreme difference has caused me considerable perplexity, for this seems to indicate much more than individual variation, and, in fact, rather more than varietal difference. These extremes represent two forms which show in the hundreds of specimens examined, but a small percentage of gradation. Then the smaller form is smoother and whiter, with the first three whirls nearly, equal in diameter; all are more bulging, and only 10 in number. These characters certainly show a strong tendency toward assuming specific rank, and with complete isolation from the larger form, would soon become fixed enough to warrant a name, but as the shells inhabit a very limited area, I leave them as they are for the present, under the name of S. incana.

Mr. W. C. Binney in "Land and Fresh Water Shells of N. A.," page 247, says that he has seen a variety of S. incana with longitudinal markings; in this, however, I cannot well avoid thinking him mistaken, some other species evidently being indicated. In his quotation of locality of specimens, he gives Key Biscayne, Fla., and from this island he may have got his colored specimens. As this latter named place is over 100 miles, in a direct line, from Key West, with numerous water ways through which the tides sweep with great force, between, this distance would afford more than sufficient isolation for the evolution of a distinct species, even if the original stock were S. incana. This seems to be a matter that requires special investigation, and for further remarks upon this subject see under head of Observations in forthcoming species.

Known from all other species, by the absence of striations, white color, with the very pale interior, small size, thin shell, and short teeth,

DISTRIBUTION AND HABITS.

The Gray Strophias occur in a limited area, on the island of Key West, Florida. According to my experience they are restricted to that portion of the northern side of the key that lies between the salt ponds and the Gulf of Mexico. In habit they are somewhat peculiar, as many hybernate beneath stones, and as spring advances, emerge to feed upon the short herbage that grows rather scatteringly in the section in which they live.

This species is said to occur in Cuba also, but I have never seen a specimen from that island, nor have I ever met with it on other of the Florida Keys.

NOTES ON THE ANATOMICAL STRUCTURE OF THE CROWNED CRANE.

The following notes were taken from a dissection of a Crowned Crane, (Balearica) which had been kept in confinement in one of the "dime museums" in Boston. The body was kindly presented to me by Mr F. B. Webster.

Tongue, about two inches long, pointed, fleshy at base, but becoming horny at tip. Superior larynx, fairly well developed, but exhibits nothing remarkable in structure.

Trachea, simple, rounded, and unlike this organ in many other members of this family, does not make any convolutions, nor enter the keel of the sternum, being straight. It is 14.00 long to the inferior larynx.

Inferior larynx, provided with a sterno trachealis that is well developed, but there is not the slightest vestige of any other laryngeal muscle. The bronchials are furnished with wide tympaniform, or vibrating membranes that extend their entire length. The os transversale although present, does not support a semiluna membrane, thus the broad tympaniforms are the only sound producing organs, with the sterno trachealis as a relaxor. If the voice of this Crane has any of the peculiar resonant harshness of other members of the family, it is partly due to the great length of trachea, thus being produced much as in the herons.

Œsophagus, straight, being without any special dilatation and is 18 00 long.

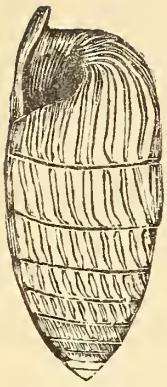
Proventriculus is comparatively small, the glands are numerous, small, spherical in form, and are contained in a zonular band which is 1.30 wide.

Stomach, a flattened sphere measuring 2.40 by 2.15 by 1.45, is very muscular, the walls being extremely thick, — 1.00 — and the lining membrane is hard, rugose, somewhat wrinkled, and orange in color.

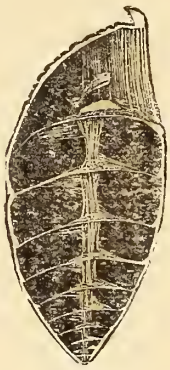
Fold of the duodenum, 4.20 long, enclosing a singularly formed, double, or forked pancreas that does not extend within 1.25 of the end of the fold, but reaches considerably beyond it, along the intestine; it is 3.50 long.

Gall sack, large, perhaps abnormally so, as noticed in many birds kept in confinement, and a double gall duct enters the intestine just below the termination of the pancreas.

PLATE VII.



17a.



17b.

17.

16.

16a.

15a.

15.

18.

18a.

19.

19a.

20.

20a.

21a.

21.

C.J.M.

EXPLANATION OF FIGURES ON PLATE VII.

15. Strophia perplexa, front view of type shell; 15a, left side of another individual.

16. Strophia nitela, front view of type shell; 16a, left side of the same individual.

17. Strophia alba, front view of type shell; 17a, left side of same individual.

18. Strophia lentiginosa, front view of type shell; 18a, left side of the same individual.

19. Strophia fusca, front view of type shell; 19a, left side of same individual.

20. Strophia incana, front view of shell; 20a, right side of the same individual.

21. Strophia inflata, front view of type shell; 21a, left side of same individual.

DISEASED FEET OF A CHIPPING SPARROW.

On Sep. 10th a Chipping Sparrow, Spizella socialis, that had the feet diseased in a singular manner, was picked up dead in the street, by a young lady, and brought to me.

A cancerous growth, partly soft and partly hard, had attacked the feet, tarsi, and most of the toes, while it had extended to the lower portion of the tibia of one leg. The right foot was the most affected, the disease extending over the entire posterior toe, see Fig. 29 A, a, where the inside of the foot is illustrated, excepting a portion of the nail, and covered the basal joints of the anterior toes, while the middle toe, ib. c, has an additional detached tubercle on it. The tibia, ib. g, is not affected noticeably.

The left foot is not quite so much enlarged, see ib. B, where the inside of the foot is represented, but the posterior toe is twisted forward and partly covered, ib. d; the middle toe, ib. e, has a large, globular, terminal lump, completely covering the nail. This tibia, ib. b, is much swollen.

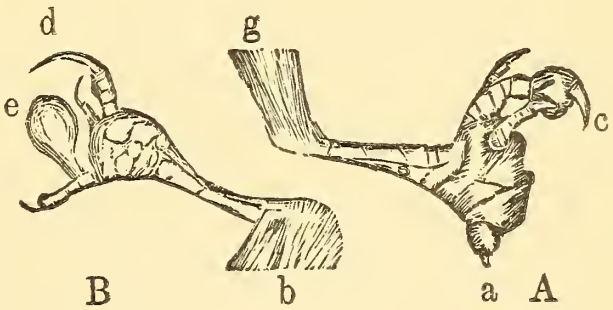


FIG. 29

That the bird managed to exist in this distressing condition, is singular. As it was young, hatched this year, it is possible that it was fed by its parents sometime after it was fully grown, then when finally abandoned by them died. It appeared much emaciated and I had intended making a more thorough examination of it, but unfortunately it was eaten, feet and all, by a cat which up to date, however, has exhibited no signs of having been affected at all, by this unique meal.

MONOGRAPH OF THE GENUS STROPHIA.

(CONTINUED FROM PAGE 79.)

Since writing the article on S. incana, I have received, through the kindness of Dr. Velie of Chicago, specimens of a striped species of Strophia, from Key Vaccas, Florida, that is evidently the shell that Binney figures as a striped S. incana. For proof that this is a distinct species, see forthcoming article under the head of S. fasciata, where this species is described.

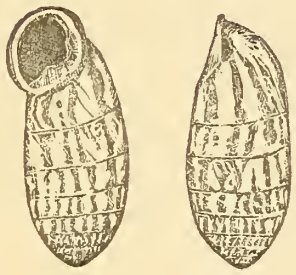
21. STROPHIA INFLATA.

Swollen Strophia.

Plate VII, 21 & 21 a, shell: FIG. 30; A, front, B, left side.

DESCRIPTION.

SP. CH. Size, medium. Shell, heavy. Striations are absent. Whirls, 10. Teeth, two, and short. Examined 25 specimens.



A B

FIG. 30.

Form of shell, cylindrical, with the second and third whirls the largest in diameter, the first and fourth are a little smaller, the fifth is considerably smaller than the fourth, and from this, the shell slopes rapidly to a blunt rounded, nearly hemispherical apex, forming a wide angle of nearly 90 degrees. The surface is polished but is slightly furrowed with lines of growth, which are much less prominent on the lower whirls. The sutures are shallow, and the whirls between them are slightly bulging.

Aperture, of medium size but open, and measures considerably more just within than at the entrance. Lower tooth, very slightly developed and is raised by gradual elevation from the surrounding surface. It is about .10 long. The upper is situated considerably above, is about as prominent, but is more conspicuous within.

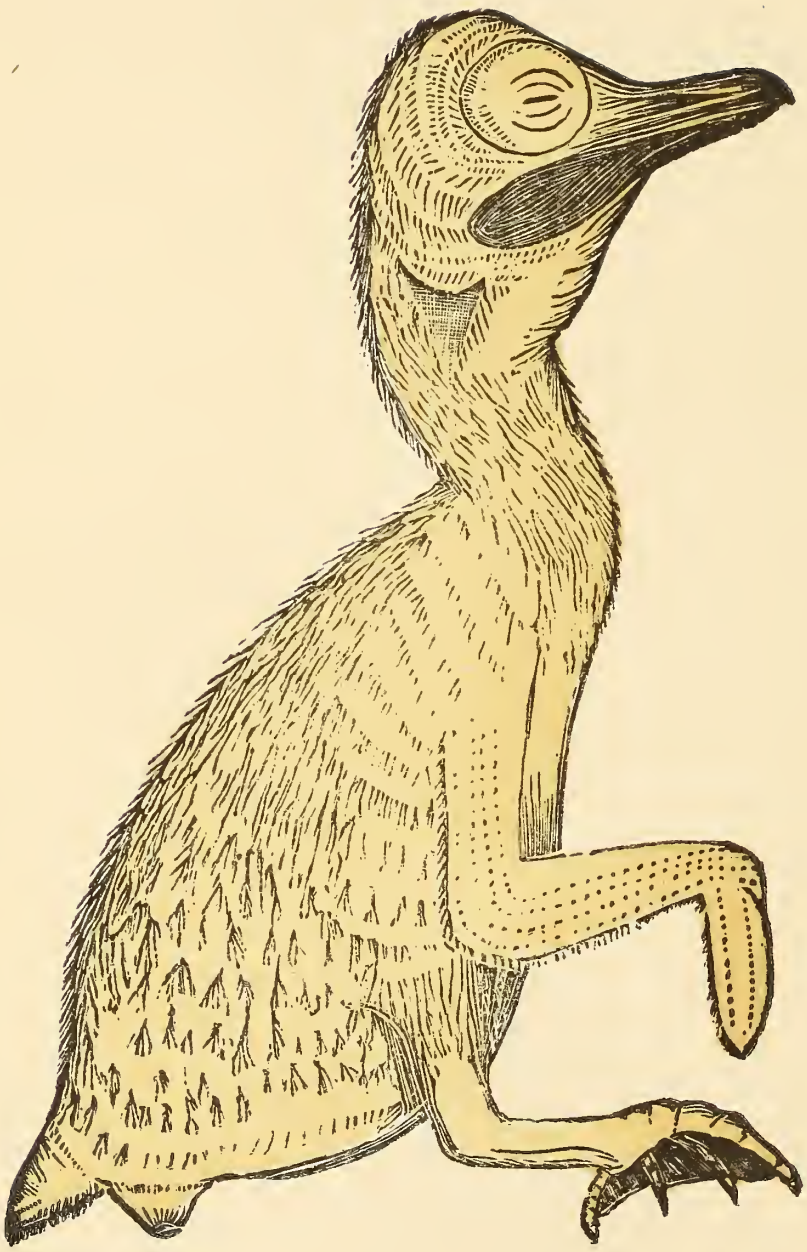
Margin, not produced forward as far as the diameter of the shell, is inclined slightly backward and a little to the right; it is not thickened and the outer portion is produced into a thin but not prominent edge which is not rolled downward. The frontal bar is not prominent, being interrupted in the middle.

Color of shell externally, white, conspicuously striped with yellowish brown that becomes nearly yellow on the lower whirls, and which occupies the last two, wholly excluding the white. The margin, frontal bar, and teeth are yellowish, and on the lower wall, within the aperture, are purplish brown stripes that merge into the universal purplish brown of the interior.

DIMENSIONS.

Size of types, .90 by .35. Largest specimen, 1.00 by 37; smallest, .90 by .35. Longest specimen, 1.00; shortest, .90. Greatest diameter, .37; smallest, .35.

PLATE XI.



EXPLANATION OF FIGURE ON PLATE XI.

Sula coryi Mayn., Cory's Gannet, young, about two days old, taken on Little Cayman, April 24, 1888. Life size; drawing made from a recent specimen.

OBSERVATIONS.

Although in some specimens the first whirl is but little smaller than the second, it is always some smaller, and in the majority of cases, noticeably so, and also in many instances, the third whirl is larger than the second. There is a decided inclination among some individuals, to have the margin slope considerably backward, thus possibly constituting a form. The markings described are very constant, as well as the number of whirls.

This well marked species may be at once distinguished from the short toothed Strophias, by the inflated lower portion, absence of striations, heavy shell, and stripings.

DISTRIBUTION AND HABITS.

The Swollen Strophias occur at Salena Point, Auklin Islands, Bahamas, where they were collected by Dr. Henry Bryant of Boston, many years ago. I obtained the specimens from which I made the above description, from the collection of the Boston Society of Natural History, where through the courtesy of Mr. Samuel Henshaw, I was permitted to examine the Strophias.

STROPHIA MARITIMA Pfr.

Seaside Strophia.

Pupa maritima Pfeiffer, Wirgm. Arch., 1839; I, p. 353.
Plate XIII, 1 & 1a, shell: A, front, B, left side.

DESCRIPTION.

Sp. Ch. Size, rather large. Shell, heavy. Striations, absent. Whirls, 11. Teeth, rather short. Examined 50 specimens.

Form of shell, an elongated cone, inclined to be cylindrical, with the first and second whirls equal in diameter, the third is but little smaller, then the shell tapers to a rather acute point, forming an angle of 60 degrees. The surface of the shell is not particularly smooth, being somewhat thickened by lines of growth and some few excrescences. The sutures are not deep, and the three upper whirls between them, are only slightly bulging, the remainder not at all.

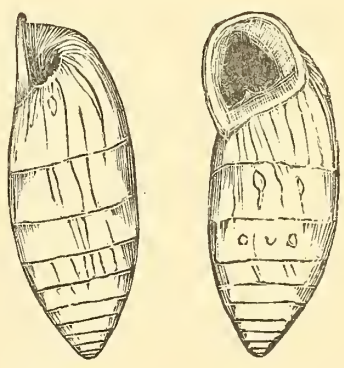


Fig. 31.

Aperture, large and open, narrowing quite rapidly within, attaining its minimum size about .15 from the outside edge of the margin. Lower tooth, not prominent, and is situated a little to the right of the center. It is about .03 high and .10 long. The upper is situated just above it, and is represented by a mere elevation, as seen from the outside, but attains some prominence within.

Margin not produced forward quite as far as the diameter of the shell, does not slope backward, but is inclined considerably to the right. It is thin and the edge is rolled backward into quite a prominent, though blunt edge. The frontal bar is complete, but not prominent.

Color of shell, externally, chalky white; internally, gradually becoming yellowish.

DIMENSIONS.

Size of specimen figured, 1.25 by .47. Largest specimen, 1.30 by .50; smallest, 1.20 by .45. Longest specimen, 1.30; shortest, 1.25. Greatest diameter, .50; smallest, .45.

OBSERVATIONS.

The Seaside Strophia is allied to S. incana, from Key West, but differs in being heavier, larger, with a more open aperture, and a somewhat flanging margin; this last named character being possessed by many Cuban species. It belongs to a group of smooth, thin-margined, short-toothed Strophias, and may be distinguished by these characters combined with the open aperture, rather flanging margin, and pure white color.

The shell here figured and described is unquestionably the Pupa maritima of Pfeiffer, and was kindly given me by Prof. H. A. Ward, of Rochester, who obtained it from Punta de Maya, Matanzas, Cuba, and this is the locality from which Pfeiffer's type came.

DISTRIBUTION AND HABITS.

Matanzas, Cuba, is the locality from whence all of the undoubted shells of this species, that I have seen, came. I have never met with it living, thus know nothing of its habits.

23. STROPHIA DALLII Novo.

Dall's Strophia.

Plate XIII, 23 & 23a, shell. Fig. 32, front, A, transverse section; o, upper, terminal portion of channeled tooth; c, frontal bar; e, channeled tooth, enlarged. Fig. 33, left side.

DESCRIPTION.

Sp. Ch. Size, rather large. Shell, heavy. Striations, present. Whirls, 10. Teeth, two, the upper inconspicuous, the lower extremely long and channeled. Examined 25 specimens.

Form of shell, cylindrical, with the first three whirls of the same diameter, the fourth is but little smaller, and from this the shell slopes to a rather blunt point,, forming an angle of 60 degrees. The sutures are very shallow, and the whirls between them bulge but little.

The striations are very numerous, 50 on the first whirl, are not arranged in lines, yet are quite regular; they are slightly inclined from right to left, and the interspaces are a little narrower than the prominences. The striations are rounded on top and polished.

Fig. 32.

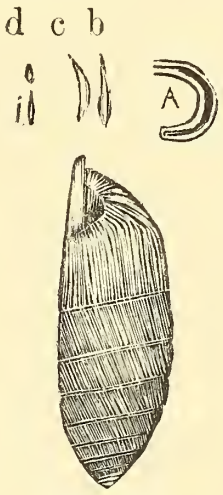


Fig. 33.

Aperture quite large and open, but narrows rather rapidly within. The lower tooth is not very prominent, but extending backward along the lower wall about .15, becomes widened and channeled, and in this form passes downward, terminating on the right side of the third whirl; its length is thus about .75! Its position is a little nearer the column which it encircles, than to the outer wall. (See Fig. 32, A, where is given a life size view of the upper portion of the tooth, the top of the shell having been removed; o, shows the tooth; c the frontal bar.) The upper tooth is a mere prominence, but gains in size as it passes backward, and makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, slopes slightly backward, and is a very little inclined to the right, is rather thick, measuring .06, and the edge is rolled slightly backward, but is not thin. Frontal bar, well developed, and the lower wall of the aperture within it is smooth, but the striations are slightly apparent beneath the enameling.

Color of shell, externally, shining white, sparingly mottled with red-

dish, but more prominently on the smaller whirls. The outer margin is white, but within, there being an abrupt line of demarkation, it is dark purplish brown.

DIMENSIONS.

Size of type, 1.20 by .42. Largest specimen, 1.22 by .45; smallest, 1.18 by .40. Greatest diameter, .45; smallest, .40. Largest specimen, 1.22; smallest, 1.18.

OBSERVATIONS.

Specimens do not vary essentially from the type. This is a remarkable shell. In it we find the maximum number of striations, no other known species having so many. It may be considered the type of a group of Strophias having the peculiar channeled, greatly elongated tooth. These, as far as my present knowledge extends, are confined to the island of Inagua, where all of the species of Strophia are thus characterized.

By the teeth alone, the Strophias may be divided into at least four sharply defined groups, as follows:–

Lower tooth, greatly elongated, channeled; position, central.

Lower tooth, projected backward along the lower wall, at least beyond the first whirl and channeled excepting on upper termination. (See Fig. 32, A, where is given the upper termination of the channeled tooth of S. dallii; o, being the tooth and c, the frontal bar; e is the upper termination greatly enlarged, showing beginning of channel. At Fig. 33, A, is the lower termination of the tooth of S, pallida.) Habitat of species, Inagua, Bahamas. Type, S. dallii.

Lower tooth, elongated, simple; position, central.

Lower tooth, projected back into the aperture for a distance at least four times its height, but it is not channeled, being a simple pyramid. (See Plate II, 1c, where a side view of the elongated central tooth of S. pannosa is given; in Fig. 33, a top view of the same is represented; at ib. c, is given the top of that of S. copia; the top of that of S. nana is figured at ib. i.) Habitat of species, the Cayman Islands. Type, S. pannosa.

Lower tooth, short; simple; position, central.

Lower tooth, short, its length being no more than three times its height, and its position is about central. (See Plate VII. 17b, where

is given a side view of the short tooth of S. alba, and Fig. 33, b, where is represented the top of the tooth of S. neglecta.) Habitat of species, Bahamas, —excepting Inagua— Cuba, and probably Hayti. Type, S. neglecta.

LOWER TOOTH, SHORT; SIMPLE; POSITION, NOT CENTRAL.

Lower tooth, very short, its length being no more than twice its height, but its position is considerably to the right of the center, being, in fact, placed nearly on the column. (See Fig. 34, A, where is given an enlarged cut of the teeth, lower and upper, of S. uva, showing the near proximity of the two, and the position of the lower, almost on the column.) I cannot at present clearly define the habitat of the species of this group. It is, however, safe to say that they are found on the more northern of the Windward Islands, and some of the keys off the north coast of South America—Curacoa and vicinity. Type, S. uva.

[NOTE. The material examined upon which the foregoing conclusions are based, consists of at least three fourths of the known species of Strophia. Of course among the large amount of fresh material to be gathered, for without doubt, nearly every island among the Bahamas and other West Indies, not yet explored for Strophias, will yield one or more species, forms may occur that will, perhaps, cause me to modify my ideas somewhat, but I have considered it best to give this exposition of my studies upon the group up to date, in order that students may better understand my descriptions. Further remarks upon this head will be given under General Conclusions.]

An understanding of these groups, as defined, is of great importance in determining species in Strophia. Of course, other characters are often constantly found in a given group. For example, the Inagua Srophias, having the channeled tooth, are nearly always cylindrical, the the first three whirls being about equal in diameter, while the striations are fine and numerous. Both of these characters are also found in the short toothed group, but here they are not constant, nor do they always occur together. Other groups possess other characters, to be mentioned elsewhere. In fact, it is nearly always possible to find species in one group that bear a superficial resemblance to others in different groups, when they are really utterly different.

The sharply defined difference in the teeth, as pointed out, becomes of more importance when we consider that specific characters are much less prominent in Strophia than in many other genera of shells, although as constant as those more easily perceived. Thus these groups become, in a measure, sub-generic.

It is a well known fact that in some genera, or even families, in all classes of animals, species are much more closely allied than in others, and that certain characters are constant in some genera, thus are available in defining species, which are inconstant and thus valueless for this purpose in others.

Any naturalist, not narrowed down to a specialty, will acknowledge the truth of the above made statement, as his attention must be constantly called to it in his investigations.

Again, we must acknowledge that groups of animals in which species are not readily defined, require the closest study in order to clearly understand just what characters are of value in deciding specific rank.

The genus Strophia presents one of these very problems, and whether from the difficulty of recognizing species, or from some other cause, has been strangely neglected, as I have had occasion to remark many times, by naturalists on this side of the Atlantic. It is true that there is quite an extensive literature upon Strophia in connection with Pupa, but very much of this is valueless on account of too great generalization in describing species. Then again, two, or more, species are often included under one name, consequently descriptions become very confusing.

I may appear to be making a sweeping statement here, but am sure that I am correct in this assertion. As proof of this I have only to bring forward the fact that in some of the largest collections in the country, that have been examined by me, names are applied to comparatively few species, and when applied are often obviously wrong, as the same name is, in many cases, appended to more than one species, while on the other hand, instances are not wanting where the same species has received different names!

Now I do not pretend that I have done any more than any one can do in the study of Strophia, who has modern ideas regarding species and the requisite training. But I have given the subject very much attention and thought. It is true, that I have much to learn, for there is a broad field still before me, but as far as I have been the matter appears perfectly clear to me.

I cannot help feeling that many conchologists, at least in America, are unfamiliar with this genus through prehaps having neglected it as of not sufficient importance to warrant the application and thought that the subject merits. I may say, however, that since the appearance of the first number of my monograph, I have met with much kindness, as well as encouragement, from many prominent naturalists who have aided me in many ways in prosecuting my researches.

I wish to emphasize the assertion. made before, that no one species of Strophia, with rare exceptions, is found on different islands, unless recently transported by commercial intercourse. Two instances where this has occurred, are in S. copia and S. intermedia, and I must now record another. Among the Strophias belonging to the Smithsonian Institute are a lot of undoubted S. inflata, labelled as coming from Exuma, the type being from the Bryant collection, taken at Salina Point, Auklin Island, 100 miles distant.

Of course in making the above written statement I do not wish to be understood to say that simple geographical bounderies constitute specific rank. As shown in many instances, Strophia is an exceedingly plastic genus; that is, for some reason, now beyond our knowledge, species become evolved quite readily, and in conformity with a law of evolution, most readily toward the center of the greatest distribution of the species. Hence it is, that if by any chance, some members of a species become isolated, either by being transported to a separate island, or to some section of the same island where they are isolated by the surroundings, and as pointed out already under the habits of S. nana, comparatively little is necessary to so isolate them, they are apt to speedily assume specific characters. This is, prehaps, caused by different environment, different food, or possibly wholly by an inherent tendency to vary from the parent stock.

As shown, especially under observations in S. copia, there is a great tendency to assume forms, under apparently the same environment, and these forms generally indicate the specific characters that will be assumed by isolated individuals. For example, I find that among a large series of S. incana from Key West, some few individuals which show faint indications of brown fleckings, and Dr. Dall writes me that in the Smithsonian collection are specimens of undoubted S. incana that are flecked. Now this is exactly what I should expect to see, for it is in perfect accordance with the law of evolution of which I have been speaking, and clearly indicates the flecked S. fasciata found at Key Vaccas.

Now through the operations of the well known law of reversion, (a law too much ignored by naturalists practically, although generally recognized by them,) individuals among nearly all species, especially if recently evolved, will show a tendency to revert toward the parent stock; this is eminently true in Strophia, and to this cause, in connection with the foreshadowing of species, explained above, is due much of the apparent confusion in many species which are closely allied, but really distinct.

In studying Strophia, I have always endeavored to first thoroughly understand the intricacies of the oscillations of individual variation, —greater in some species than in others—then have indicated the more or less set forms that have passed beyond mere individual variation, but which have not lost the links that bind them to the parent stock; thus have been prepared to recognize species, even if closely allied, wherein there are no true connecting links.

In concluding this digression, which I have considered necessary to make at this time, I shall recapitulate somewhat in the following remarks, in order to emphasize some of my assertions.

The genus Strophia is larger and much more important than has been supposed. On this side of the Atlantic, at least, it has been much neglected, and consequently many collections are in a sad state of confusion regarding proper names being appended to species. Many easily recognized species have received the same name, and the same species sometimes bear different names in the same collection, (in one instance two lots of one species labelled as coming from one locality, have received different names, both of which are in the same handwriting!) while in many cases the same species bears different names in different collections. Much of this confusion is due to the fact that, with a few exceptions, writers upon Strophia, especially the older authors, have not given enough attention to details, hence one description often embraces more than one species. They have scarcely ever recognized the importance of isolation as indicating species, and are thus apt to assign too wide a range to one species.

Many students of today in endeavoring to identify species by these descriptions have tried to make too few names fit too many species, and through an unfamiliarity with the subject have not observed their error.

Indvidual variation is sometimes comparatively great in species of Strophia, yet this has its limits, becoming overbalanced into forms, and these, in turn, into species. A tendency to indicate the species that has been evolved through the isolation of individuals, by a greater or less prominence of some particular character, on one hand, and reversion in some specimens of that recently evolved species, will sometimes form what are apparently connecting links between the two species. Such apparent links are, however, always represented by a very small percentage of specimens, and a close study of them, will, in all cases, show to which species each belongs. Strophia, to be understood, requires careful study and attention, more so than most genera of shells, but when once mastered, certain characters that before seemed obscure, now become perfectly clear.

In making the foregoing remarks, I have frankly and freely stated the conclusions to which I have come, after a long, and most careful consideration of the subject, my sole object being the advancement of our knowledge of the genus Strophia. If I differ in opinion from some authors whose descriptions I have considered too general, it is not because I do not appreciate their labors, but rather because I take a different view of the matter from what they then took. I thoroughly believe that the time has come when the utmost minuteness of detail has become necessary in defining groups in nature, of whatever grade, but more especially is such minuteness of description needful in working out the details of specific and subspecific characters.

It must be constantly borne in mind that we of today are working as much, if not more, for the benefit of the coming generations as for that of the present. He who is a student of evolution must admit constant change, and to him it becomes most obvious that too careful attention cannot be given to minute differences in recording the present condition of the species or subspecies in hand, as thus, and only thus, can our work be available in the future to those who wish to mark the steps of change.

I do not intend to be understood that I would for a moment think of recording differences in Strophia which are not constant and of sufficient specific importance to warrent so doing, and I am sure that I have not done so, as I feel confident that no one who will give the matter the careful attention that it merits, will disagree with me.

Strophia dallii may be known by the numerous striations—more than in any other described species—the cylindrical form, and channeled tooth. I have dedicated this species to the accomplished naturalists, Dr. William H. Dall, curator of mollusks at the Smithsonian Institute, Washington, D. C., as a slight testimonial of my appreciation of the value of his scientific researches.

Among the channeled toothed Strophias should be included the previously described S. ianthina and S. pallida.

DISTRIBUTION AND HABITS.

The first specimen of Dall's Strophia that I ever saw, I found in my Bahama collection of shells, but unfortunately labelled so that it was uncertain whether it came from Inagua or not. Later I found a few of this species in the collection of Mr. James A. Southwick, but again I was unfortunate in not getting the locality. It was only upon receiving a series of the Smithsonian Strophias, kindly forwarded to me by Dr. Dall, that I found the species labelled as coming from Inagua.

(CONTINUED.)

THE ARROW-HEADED WARBLER, OF JAMAICA.
DENDROICA PHARETRA.

The arrow-headed warbler, Dendroica pharetra, which is figured on Plate IX, was described by Philip L. Gosse, in 1847 in his "Birds of Jamaica", page 163. This representative of the large family of American warblers, confined as it is in habitat to the island of Jamaica, appears to be quite rare in collections. It does not seem to be very common even on its native island, and Mr. Gosse met with but one specimen, which he captured on the top of Bluefields Peak, on the 9th of February. He observed nothing characteristic in the habits of this individual. My own experience with the living species is limited to seeing two on a steep mountain side, near Kingston. They were searching for food among the low branches of the surrounding woodland, in the manner of their kindred, and after giving me a moment's opportunity to observe them, they disappeared in the intricacies of the luxuriant foliage, while I pursued my way upward: so we parted, none of us worse off for the encounter. I heard no song, nor did I ever see a description of it. In fact, I believe that the complete history of these denizens of one of the fairest islands that the sun ever shown upon, remains to be written.

THE NICTITATING MEMBRANE
AND CRYSTALLINE LENS IN THE MOTTLED OWL.

In the mottled owl Megascops asio, the nictitating membrane, or third eyelid, is exceedingly well developed, most admirably illustrating the method of opening it. The accompaning cuts are a little smaller than life.

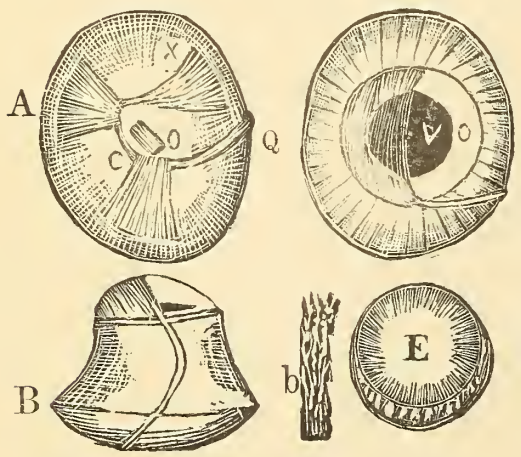


Fig. 34.

Fig. 35.

Fig. 35, A. shows the nictitating membrane partly covering the pupil v. and iris, o. It is drawn over the eye by a muscle attached to the lower corner. see Fig 35, A, Q, passing down the side, Fig. 34, B. Q. over the convexity of the lower surface, ib. A, Q. around the optic nerve, c, to terminate in the flat, triangular, contractile body, ib. A, x. In pass-

Delaware River we experienced another cold wave, the wind being northwest, and quite high.

On Nov. 12th. in Pamlico Sound, North Carolina, we again came up with the Swallows, here we saw a large flock flying about the marshes of the western side. They were still about on the following day.

Dec. 29th., at St. Catherine's Sound, Georgia, I shot a White-bellied Swallow out of a large flock that were flying over the marshes. The next day was very cold, there having been a hard frost during the night, consequently the Swallows disappeared.

Jan. 4th., we again caught up with the Swallows at St. Simon's Island, Georgia, but there were only a few specimens.

On Jan. 7th., when near the St. Johns River we saw the Swallows once more, and being now in the milder climate of Florida, saw them nearly every day. They are constantly resident in Florida during winters, but wander about the state in large flocks, apparently visiting various portions, but never remain long in one place north of the middle section. In the vicinity of Indian River they may be seen every day. It is probable that this portion of Florida, and southward, is the winter home of the White-bellied Swallows, and that during warm spells some wander further north.

By the foregoing notes it will be seen that this species of Swallow keeps only just so far beyond the reach of cold as will warrant it finding a sufficient supply of food, although in autumn the White-bellied Swallows eat a large number of the fruit of the bayberry, at least while they are in Massachusetts, yet it is quite probable that they cannot subsist on this diet long, but must also obtain some insects. That they do subsist for a time upon bayberries after the frosts have destroyed many of the insects which form their habitual means of sustenance, shows that they migrate with considerable reluctance. Thus, while it is probable that the White-bellied Swallows cannot endure any great degree of cold, they certainly do remain in the north long after frosts, and thus their migrations are governed, in a great measure, by the food supply.

MONOGRAPH OF THE GENUS STROPHIA.

(Continued from Page 135.)

24. STROPHIA UVA Linn.

Grape Strophia.

Plate XVI. 1 & 1a; Fig., 51, shell.

Turvo uva Linn. Syst. Nat., XIII ed..p. 364, No.68

DESCRIPTION.

Sp. Ch. Size, medium, Shell, not heavy. Striations, present. Teeth, two, very short and both close together, Whirls, 11, very narrow.

Form of shell, short and oval, with the greatest diameter at the third and fourth whirls, while the first and fifth are about equal in diameter, from the fifth whirl the shell narrows gradually to the rounded

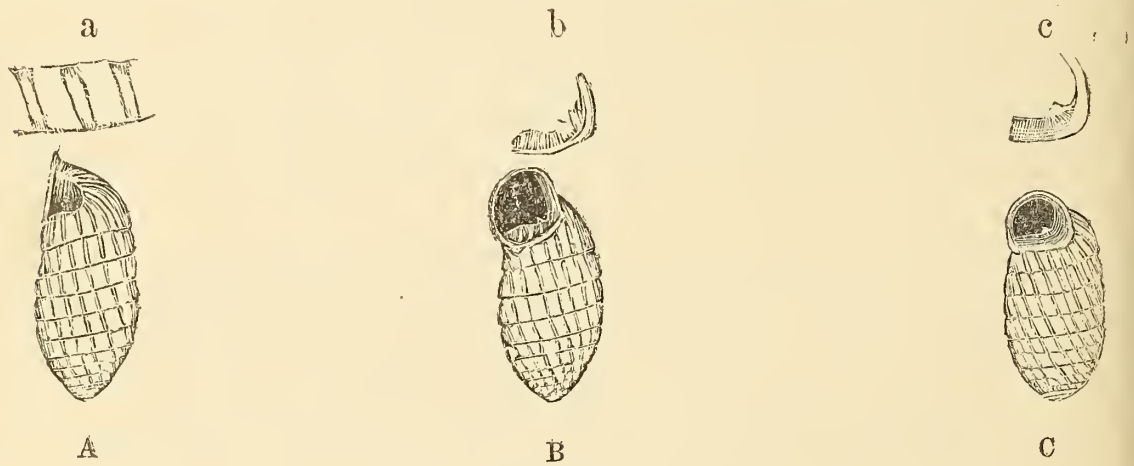


Fig. 51.

apex. The whirls, excepting the first, are narrow, the second, third, and fourth being of about the same width, while these and the fifth, taken together equal the first. The striations are quite prominent. Fig. 51, a, (where they are enlarged) 22 on the first whirl; they are very regularly arranged in lines, and are about an equal distance apart, the interspaces being a little wider than the prominences. The striations are smooth and rounded on top.

Aperture, small and contracted, measuring a little less within, than at the entrance. Lower tooth, small, not over .02 high by .05 long, and is placed well over to the left of the center, and just above it, not over .02 distant, to the very short upper tooth, see ib., b, for an enlarged cut of these remarkable teeth,

Margin, not produced forward quite as far as the diameter of the shell, is slightly inclined to the right, is thin, measuring only about .02, and the outer posterior portion is rolled slightly downward, and produced

into a thin edge. The frontal bar is prominent enough to interrupt the striations.

Color of shell, externally white, polished and shining internally and on the striations, within the aperture there is a faint tinging of yellowish.

DIMENSIONS.

Size of figured specimen, .87 by .37. Largest specimen, .90 by .40; .75 by .35. Greatest diameter, .40, smallest, .35. Longest specimen, .90, shortest, .75.

OBSERVATIONS.

Among the shells of this singular species, that have passed through my hands there is considerable variation in form, teeth, and in number of striations. The widest departure from the types in regard to form is one in which the first four whirls are of the same diameter, then the shell tapers to a rather acute point. A second form has the first four whirls of the same diameter and with the apex rounded as in the type. Neither of these forms have the bulging appearance so characteristic of the species. It is remarkable that of two cylindrical shells before me one has one tooth only, and the other has none. This and the pointed form may each constitute a species, as it is possible that these characters are constant, and that the shells which are so marked come from different locations. The specimen that I have figured came from the collection of the Boston Society of Natural History and was labeled as coming from Curacoa, while others which I have, nearly similar, are labeled as having been collected on Guadaloupe. The one-toothed and toothless specimens are simply labeled West Indies. (See Fig 51, c.)

Typical shells of this species may be at once recognized by the narrow aperture, with the teeth close together, thus constituting a group, as noted on page 131, the narrow whirls with their prominent striations, arranged in regular lines, and the peculiar bulging form below the middle of the shell.

HISTORY AND DISTRIBUTION.

This species, although the very oldest described shell of the genus, appears to have been recognized by many conchologists from the first, while nearly all have described it correctly; where a figure has been given it is clearly of this species. I most heartily wish that the status of all of the older described species were as easily established as this. (In this connection see remarks under head of S. mumia.) This is somewhat remarkable, as the description given by Linnaeus most certainly could be applied to almost any of the smaller Strophias with striations, although to few, and not even to this, excepting to the form mentioned, can the term "apatura unidentata" (aperture one-toothed) be applied.

I append Linnaeus' original descriptions, with a translation, and also Sylvanus Hanley's remarks on the type which he has examined in the collection of Linnaeus.

Description of Turbo uva as given in the thirteenth edition of Linnaeus' Systema Naturae, page 3604-3605, No. 68.

"T. testa cancellata ovata obtusa: anfractibus contiguis: striis longitudinalibus imbricatis.

Habitat in mari, Americanum australem, alluente, testa ab 1 1-2 pollicem longa, alba, cincerea aut spadicea, umbillicata, anfractibus circiter 12 primo-triplo majore secundo: sulcis intermediis striis æqualibus, apatura unidentata."

Shell, obtuse oval, whirls close together, striations, longitudinal and overlapping.

Habitat in the ocean of Southern America and in rivers; shell one and one half inches long, white, cincerous, or chestnut, umbilicated, encircled by twelve whirls, the first of which is three times as large as the second. Sutures between the equal striations, aperture one toothed.

Sylvanus Hanley in the Shells of Linnaeus says; "The Pupa uva of Pfeiffer's Monograph alone of the shells in the cabinet of Linnaeus, who has recorded his possession of the species, answers to the definition of this common shell". (Ipsa Linnaei Conchylia. The Shells of Linnaeus, Determined from his Manuscripts and Collection; by Sylvanus Hanley. London, 1855, page 343.)

25. STROPHIA MUMIA Brug.

Mumia Strophia.

Plate XVI, A, B, C, & Fig. 52, A, B, C, shell.

Bulimus mumia Bruguiere, Encyclopedie Methodique; Nat. His. Des Vers, I, page 348, No. 87.

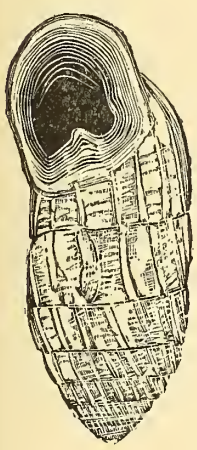
DESCRIPTION.

Sp. Ch. Size, very large. Shell, heavy. Striations, present. Teeth, two, not long nor high. Whirls, 10 to 12.

Form of shell, cylindrical, with the first three whirls equal in diameter, the fourth is but little smaller, but from this the shell slopes to a point, forming an angle of about 65 degrees. The first whirl is long, occupying almost one half of the length of the shell; the second whirl is as wide as the third and one half of the fourth, the fourth is equal in width to the next two lower, and each successive whirl is of the same proportionate width. The striations are not numerous, (20 to the first whirl,) they are not very prominent, are irregular in form, and not ar-

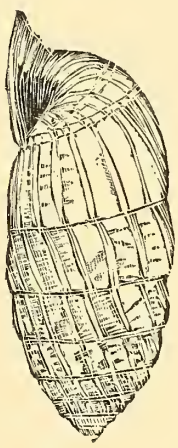
ranged in lines, are only very slightly inclined from right to left, and the interspsces are about twice as wide as the prominences. The striations are very slightly furrowed on top, but the edges are round and polished.

The aperture is very large and open, measuring considerable more within than at the entrance. The lower tooth is proportionally short, being about .12 long, and is not high, about .04, and its position is central; the upper is situated about .10 above it, and is represented by a mere protuberance on the column.

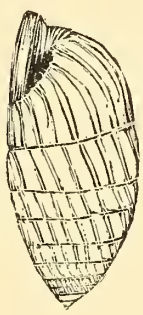


a

FIG, 52.



b



c

d

FIG. 53.

Margin not produced forward beyond the diameter of the shell, and is inclined very much to the left, far beyond the side. it is considerably thickened but becomes thinner on the edge, which is rolled backward considerably, producing a very flanging mouth, being in fact nearly bell-shaped. The frontal bar is not very prominent and the striations are not interrupted, indeed the whole interior of the shell is roughened with depressions which correspond to the external prominences.

Color of shell externally, mixed white and pale chestnut, both colors being arranged in transverse zigzag markings that are often arro w-shaped. On the body of the shell the colors are in about equal parts, but on the back of the upper whirl, the white predominates, almost to the exclusion of the chestnut. Within, the color is pale orange, fading gradually into white on the outer portion of the margin.

DIMENSIONS.

Size of specimen figured, 1.58 by .57. Largest specimen, 1.75 by 60; smallest, 1.25 by .45. Greatest diameter .60: smallest, .45. Long est specimen, 1.75; shortest, 1.25.

OBSERVATIONS.

There is an inclination in this species to become more elongated and cylindrical, thus in some specimens the first four whirls areof the same diameter. There is also some variation in color, but thecharacteristic zigzag markings in chestnut are always present.

The small-sized specimen given under head of dimensions may constitute a separate species as it is a much thinner shell, with a less open mouth, and a much narrower margin. The markings are also more distinct, the chestnut being deeper in shade.

This species may be considered as the type of a group of shells, most of which I believe inhabit Cuba, and which have the peculiar flanging mouth and zigzag markings. The markings are confined to a very limited number of species, but the open mouth is peculiar to the greater number of Cuban Strophias.

This shell may be at once recognized by the large size, flanging margin, irregularly formed, widely separated striations, which occupy all of the whirls, excepting the two lowest, and the zigzag markings which give the shell a rougher appearance than it really presents upon close examination.

HISTORY AND DISTRIBUTION.

I have said under head of the preceding species, that it is fortunate that conchologists are all, or nearly all, agreed upon just what Strophia uva is, for many of the older described species of the genus are far from being in a similar condition. The species in hand presents one of those very problems which has given me a great deal of trouble to settle.

The difficulty can be stated in a few words. In 1792, Bruguiere described in the Encyclopedie Methodique, among other shells, some of them Strophias, a species which he calls Bulimus mumia, most evidently a Strophia, although he considered it a marine shell. Now his description is so general that it may be applied to almost any species of Strophia having a flanging margin, more especially to several Cuban species. In proof of this we have only to glance at the description and figures of those authors who have described this species since, scarcely any two have interpreted Bruguiere's description in the same way, or in other words, scarcely any two have applied his name to the same species of shell.

Such being the facts of the case, as I shall endeavor to show later in this article, the question comes, to what species of flanging mouthed shell is the name of mumia to be applied? To show in the outset that Bruguiere's description is far from being detailed enough to clearly define any one species of Strophia, I give it below, first in the original Latin and French, then translated.

The description is from the Encyclopedie Methodique; His. Nat. Des Vars. I, page 348, No. 87.

T. subcylindrica, oblique sulcata, apetura semi-ovata, bidentata, fulva.

Celle-ci est marine & distincte de celle qui suit, par son epaisseur, par son volume, comme par la couleur de son ouverture & par les deux dents dont elle est armee. Elle a sur une longueur de dix-sept lignes, un demiponce de diametre & environ douze tours. Sa forme est cylindrique, mais le cote de la spire est termine en toupie, & son bout est moins, obtus que dans le Bulime fuseau; le retrecissement de cette extremite ne commence a devenir sensible que vers le cinquieme tour & presque aux deux tiers de sa longueur. La superfice des spires est presque plate & garnie de cotes, arrondies obliques, qui sont separees les unes des autres par des interstices a peu-pres egaux. Les sutures sont simples, plus profondes que dans l'espece precedente, excepte sur les cinq ou six derniers tours du sommet. L'ouverture ne differe de celle du Bulime fuseau qu' en ce qu'elle a un peu moins de longueur & un peu plus de largeur que dans cette espece; sa levre droite est epaisse & repliee a l'exterieur en guise de bourrelet, la gauche est situee comme dans la precedente & collee sur la convexite du second tour; elle offre dans l'interieur, un pli semblable, dont la grosseur est proportionnee a celle de la coquille; on voit un second pli moins eleve que la premier dans le fond de l'ouverture a la base de la columelle, qui semble dependre de la profondeur de l,ombilic. Celui-ci est situee comme dans l'espece precedente, mais il est plus ouvert & meme plus profond.

Cette a coquelle est blanche a l'exterieur, fauve ou rousse dans l'ouverture & sur les bords des levres, & rougeatre vers sommet de la spire; elle est marine & de l Ocean Americain.

Translated, reads as follow. Shell sub-cylindrical, sutures oblique, aperture semi-oval, two-toothed, yellow.

The latter is marine, and distinct from the one that follows, by its breadth, by its bulk, as by the color of its opening and by the two teeth with which it is provided. It is about 17 lines (about 1.50) in length, and one half inch in diameter and has about twelve whirls. The form is cylindrical but the end of the spire is in the shape of a top, and its tip is less obtuse than in the spindle bulime. The narrowing of this extremity becomes noticeable only about the fifth whirl, and at nearly two thirds its (the shell's) length. The surface of the cone is almost flat and provided with ribs, rounded and oblique, which are separated by nearly equal spaces. The sutures are single, deeper than in the preceding species, except about the last five or six whirls of the top. The opening differs from that of the Bulimus fuscis only in that it is a little

shorter and a little wider than in that species; its right lip is thick and turned up at the extremity like a tumbling cap, the left is situated as in the preceding (species) and is placed (stuck) on the convexity of second whirl. It presents in the interior a similar fold, whose size is proportional to that of the shell. There is a second fold lower than the first in the bottom of the opening at the base of the collumella which seems to hang from the depths of the umbilicus. The latter is situated as in the preceding species but is more open, and also deeper. This shell is white on the outside, reddish, or red, in the opening and on the edge of the lips, and reddish about the top of the cone, it is marine, and is found in American Seas.

It is evident from the foregoing description that the author had some species of Strophia that had two teeth, that is, two prominent teeth, as in the majority of speies the of genus, not as in uva, that was about an inch and a half long, by a half inch in diameter. that was cylindrical in form, but narrowed to a point from the fifth whirl, it was also provided with striations (cotes) which are oblique and separated by about equal spaces, the margin is flanging, resembling a tumbling cap, it is white externally, but reddish in the opening and on the margin.

Such in brief are the only characters which will be of any service in determining the species that the author had in hand, but unfortunatelythese will answer for several Cuban shells.

As remarked, authors in endeavoring to fit this too general description to some species of Strophia have failed to agree. A hasty review of some of the principal works on the genus will serve to illustrate just how widely authors have disagreed.

Strophia mumia was described in 1792, but no figure was given of it at that time, and the first one of a shell intended to represent this species is an Illustrated Introduction to Lemarke's Conchology, by Edmund A. Crouch, London, 1827, Plate XV, No. 2. Here is given an unmistakable portrate of the species that I have named S. cinerea, a shell, in which the development of the margin is reduced to nearly or quite a minimum, in place of being large and flanging. It is not white without nor reddish within, but the other characters given by Bruguiere might apply to this shell yet they are really generic. and will also apply to any Strophia with striations.

Next we turn to the Histore Naturelle Generale et Particulere des Mollusques, par D. De Ferussac et, G. P. Deshayes, Paris, 1820-1851, Vol. II, Plate 153, Fig. 4, 5, & 6, where is given figures of what the authors consider mumia. No. 4 is a mottled shell, but too slender and pointed for typical mumia, and is what is oftenest given as S. crysalis, both in figures and in collections, while 5 & 6 are white shells of quite

a different species. On page 208 of this work we find Pfeiffer's description as given in his Monograph copied in full.

Again in Systematisches Conchylien-Cabinet von Martini und Chemintz by H. C. Kuester, Nuernberga, 1852, Plate I, Figs. 1 & 2 we find the pointed form of S. uva, mentioned on page 175 of this work, given as mumia, while on the same plate unmistakable figures of typical mumia are labeled as chrysalis. Then on Plate XV is given another figure of what is considered also as mumia, but which looks quite like my S. alba. On page 10 we also find an exact copy of Pfeiffer's description.

In the comparatively recent Conchologia Iconica or the Illustrations of the Shells of Molluscous animals, by Lovell Augustus Reeve, London, 1878, on Plate I, 3a, we find for the first time the shell that I have also considered mumia figured, but 3b on the same plate represents quite a different shell, probably S. infanda or an allied species.

In the face of these various opinions regarding the status of a given species, it becomes somewhat difficult to decide as to what course to pursue. At first I was inclined to take the earliest recognizable figure and call the species that it represented mumia, but as shown, this is Crouch's figure of S. cinerea, a shell so widely different from that which Bruguiere had in hand when he wrote his description, and which I do not remember to have seen in any collection labeled as mumia, that I have decided not to adopt such a rule. In fact I do not see as any fixed rule can be made in regard to establishing the status of the older described species of Strophia where no recognizable figure accompanies the description. In this case I have followed what may be called universal usage, that is I have taken a species of shell which embraces all of the characters given in the original description, and which I have found in most collections labeled as mumia, and have considered it as the type of mumia. and I can see no good reason why conchologists should not uphold me in this decision.

I have access to most, if not all, of the literature on Strophia, while I have also seen some of the best collections, and shall use every available means to unravel the tangle in which many species of this genus are now involved, but it will be at once seen by any one who attempts to identify species from the short, too often obscure, Latin descriptions which are unaccompanied by good figures, that it is exceedingly difficult to determine what species the author of such descriptions had in hand when he wrote them. One has only to glance at the figures of Ferussac and Kuester cited in the foregoing article to see that both have not only figured shells quite different from mumia, but that they have each given different species from one another, and to crown all, both figure two or

more species as one, yet both had Pfeiffer's description to work with, for they have copied it, as before mentioned.

The shells of this species which I have seen have simply been labeled as coming from Cuba.

STROPHIA BROWNEI Novo.

Browne's Strophia.

Plate XVI, 4, 4A, & Fig. 53, shell.

DESCRIPTION.

SP. CH. Size, medium. Shell, heavy and robust. Striations present, but not prominent. Examined 25 specimens.

Form of shell, oval, the greatest diameter being on the second whirl, the first is very little smaller, and the third but slightly smaller than this, and from this last mentioned whirl the shell tapers to a rather blunt point, forming an angle of about 60 degrees. The striations are numerous, 20 on the first whirl, and occupy all but the two lowest whirls, are regular, but are not arranged in lines and are but slightly inclined from right to left. The striations are slightly furrowed on top but the edges are smooth and rounded, they are not widely separated, the depressions being about equal in width to the prominences.

The aperture is quite small and contracts rapidly, measuring somewhat less within than at the entrance, and the teeth are situated some distance inside the opening. The lower is short, about .05 and only .03 high, it is placed about midway between the two walls, while the upper, which is only represented by a protuberance is placed considerably above it.

The margin is not produced forward beyond the diameter of the shell, is considerably thickened, measuring about .05, and the posterior portion is provided with a thin, though not very prominent edge. The frontal bar is very prominent and completely interrupts the striations.

Color of shell, white externally, tinged with yellowish within the aperture.

DIMENSIONS.

Size of type, 1.10 by .50. Largest specimen, 1.16 by .52; smallest, .90 by .49. Greatest diameter, .52; smallest,.49. Longest specimen, 1.15; shortest, .90.

OBSERVATIONS.

Beyond question this species is related to S. alba, but whether as a remote progenitor or as an offspring it is difficult to state, although I

am inclined to think the former hypothesis the more correct one, for my studies of this genus lead me to believe that the lighter, thinner shelled species are the most recent. At all events S. brownei is distinct enough from alba at present. The shell is much smaller, thicker, with a considerably thickened margin with decided striations extending to the seventh whirl. There is a form of Browne's Strophia which has more widely separated striations than in the type, 19 or 20 to the first whirl, and these are wider on top. This form bears a strong external resemblance to S. fusca, even to a brownish tinging between the striations, but a glance at the teeth will serve to separate the two species, brownei having a short, inconspicuous tooth, while fusca has the long tooth so characteristic of the Cayman species, in short, the two shells belong to different groups. (See remarks on page 130.) There is a shell on New Providence of which I have seen two or three specimens only, which may prove identical with this, but I shall have occasion to speak of this later.

Strophia brownei may be distinguished then from all others by the thickened margin with contracted opening, with the short teeth placed well within it, and oval form.

I have named this species for my friend Mr. Frank C. Browne of Framingham, who has evinced a great interest in my work on the genus Strophia, and to whom I am greatly indebted for the use of many specimens. It was in his cabinet that I saw a shell that called my attention to this species.

DISTRIBUTIONS AND HABITS.

Strophia brownei is found on Rum Key near the north side, and occurs among low shrubbery, where it appears to be not uncommon. While crossing the key on the day that I visited Hartford Cave, mentioned in a preceding article, I saw numbers as I rode along the road and fully intended collecting them as I returned, but when I passed the place in the evening, darkness prevented me from securing any, and I did not have an opportunity of visiting the locality again.

(CONTINUED.)

PBLiCATIONS RECEIVED.

A Rambler's Lease. By Bradford Torrey. Boston and New York, Houghten, Miflin and Company, 1889.

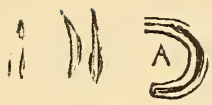
This is a charming book from beginning to end, for with magic pen the author opens wide the gates which lead into the enchanting realms of Nature, and bids his readers follow him while he converses most pleasantly of the wonders which are there. Wonders, which as Mr. Torrey shows, are in open sight, yet are seen by a very few, but under the skilful guidance of our talented author, he must be dull indeed who cannot appreciate the beauties which lie all about us. One of the most noteworthy things about this work is the fact that Mr. Torrey teaches, that much can be done toward advancing our knowledge of animals without taking their lives, This is especially shown in regard to what one cannot fail to see are his favorites among his many friends, namely, the birds, and after reading some of his chapters in which he has given an account of his feathered acquaintances, those of us who can count our avian victims by the th ousands, feel fairly ashamed of our murderous exploits. I for one can say that I shall never again take the nest of a vireo of any species with any degree of satisfaction, for I shall never forget Mr. Torrey's story of his pet, blue-headed vireos,

I read this little volume with great interest and re-read it with greater pleasure every time I take it in hand, and most heartily wish that this book could be in the possession of all of our young people. Beyond all doubt the study of Natural History is elevating to a high degree, and in this work the subject is presented so pleasingly that it cannot fail to awaken the interest of even the most apathetic.

Deep Sea Mollusks and the Conditions under which they Exist. By William Healy Dall. Authors extra from the proceedings of the Biological Society of Washington, D. C., Vol. V, 1888-1890.

In this, one of the most interesting and valuable papers upon zoology that I have ever read, the author gives with sufficient detail the changes which mollusks, that inhabit the deepest portions of the ocean have undergonein order to exist. To those who have never investigated the matter, it is difficult to understand how different the environment in these profound depths is from that in the sea nearer the surface. At 2,000 fathoms (12,000 feet) under the ocean no ray of light can penetrate the water is icy cold but above all the pressure is so great that it "may

PLATE XVI.



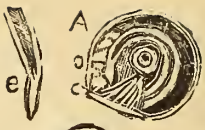
1B

a

2B

2A

b



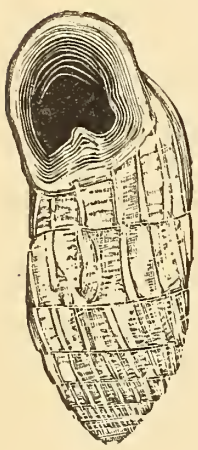
1B

c

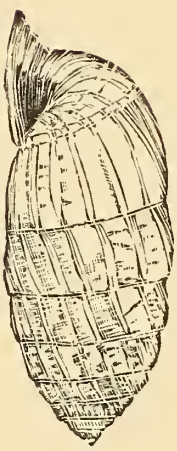
1A

1B

1C



3A



3B

4B

4A

5B

5A

6A

6B

7A

7B

EXPLANATION OF FIGURES ON PLATE XVI.

1B*. Strophia dallii, right hand figure, front view of type; left, right view of same.

2B. Strophia maritima, front view; 2A, right side of same.

1A. Strophia uva, right side; 1B, front of same; 1C, another form of same species.

3A. Strophia mumia, front; 3B, right side of same.

4A. Strophia brownei, front view of type; 4B, right side of same.

5A. Strophia viola, front view of type; 5B, right side of same.

6A. Strophia orbicularia, front view; 6B, right side of same.

7A. Strophia glans, right side; 7B, front of same.

MONOGRAPH OF THE GENUS STROPHIA.

(Continued from Vol. I, page 197.)

I continue my article upon the genus Strophia with the additional advantage of another season's work among the Bahamas. In March and April, 1893, in company with Messrs. Curtiss and Thorndike I visited New Providence, and some of the adjacent keys, Highburn, U Key, and other keys about Allen's Harbor, Andros from Fresh Creek south to Middle Bight, taking in the out-lying keys off the coast. As will be seen by the following descriptions, my ideas regarding the limited distribution of species in this genus have not only not been changed, but my opinion in this respect has been greatly strengthened. Mr. Curtiss, who is an experienced naturalist, and who followed me in my investigations step by step, examining with me the Strophias in their native haunts, early became convinced of the justice of my conclusions regarding the species.

A careful study of the keys on which Strophia occur, with the idea of accounting for their distribution, has revealed two facts. One is, that these shells never appear on any key on which palms do not grow. Another is, they do not live on any key which is not now inhabited by man, or which has not been inhabited by him in the past, or which is not now frequently visited by him, or which has not been in bygone times a resort of human beings. Palms not only indicate a more or less fertile soil, but as they are useful to mankind in several ways, prove attractive to him; hence their presence is an index of a present or past occupancy of any key. And the shells are probably transported from place to place by man.

27 STROPHIA CURTISSII Novo.

Curtiss' Strophia.

Fig. 33, A, young; B, side view of type; C, front view of the same.

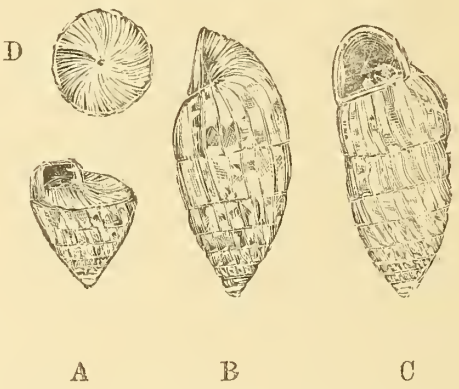
DESCRIPTION.

Sp. Ch. Size, rather below medium. Shell, rather thick and heavy. Striations, prasent. Animal almost wholly brown in color. Whirls, 10. Examined 2,000 specimens.

Form of shell, inclined to be cylindrical, the first and second whirls being nearly equal in diameter, and the third is but little smaller, then the shell slopes rather quickly to a quite blunt point, forming an angle of sixty degrees. The striations are quite numerous, twenty-six on the first whirl, not very prominent, rather irregular, and not arranged in lines; they are slightly inclined from right to left, are narrow, hence the interspaces are wider than the prominences. The striations are not furrowed, but are rounded and smooth.

Aperture, rather small, but measures a little more just within than at the entrance. Lower tooth, not very prominent, .05 high by .10 long, and its position is about central; the upper is absent, being represented by a slight protuberance.

FIG. 33.



Strophia curtissii. A, side view of young; D, end view of the same; B, side view of type; C, front view of same.

Margin, not produced forward as far as the diameter of the shell, and is very slightly inclined to the right, but not beyond the side; it is not thickened, measuring .04, but the outer posterior portion is produced backward into a sharpened edge, but which is not rolled downward. The frontal bar is quite distinct, and the striations are completely interrupted by it, never appearing within.

Color of shell externally, white, prominently and plentifully flecked with reddish brown of varying shades; internally, purplish brown, fading into yellowish white on the teeth and margin of the aperture and tooth. Apex, pale horn color.

DIMENSIONS.

Size of type, .98 by .40. Largest specimen, 1.23 by .42; smallest, .87 by .36; greatest diameter, .45; smallest, .35. Longest specimen, 1.25; shortest, .78.

OBSERVATIONS.

Individual variation from the typical locality is not great. There is a tendency to vary somewhat in fleckings, some specimens being

more heavily marked than in the type and others less heavily. There are, however, three prominent departures from the type, which if placed under different environment at any time, will form distinct species, but which intergrade so completely with the type form that I have not considered it necessary to name them, but have designated them by numbers. The type form occurs in the large cemetery to the eastward of Nassau, on the western side of a path which crosses the grounds.

No. 1. Form of shell about that of the type, but this is a rather small form, .90 by .40, with a thicker margin, (.10), projecting more forward, smaller aperture, more striations, 31 on the first whirl, with the interspaces about as wide as the prominences. The fleckings are slight and much paler within than in the type, with no distinct blotchings. This form is inclined to occur to the westward of the type location.

No. 2. An elongated cylindrical form, with eleven whirls, the first three of which are about equal in diameter, and with the remainder forming a rather acute point, having an angle of 50 degrees. The striations are fewer than in the type, 21 to the first whirl, less prominent, but with lines of growth between. The margin is thick (.07) with aperture widening from within. The fleckings are inclined to mass into blotches, but their color is pale. This form occurs to the southward of the type location.

No. 3. Of about the same form as the type, but is a larger shell, 1.10 by .45, with a very thin margin, about .03, and apertures widening from within, striations 27 to the first whirl, very regular, but not in lines. Occurs to the extreme southward and eastward of the type location.

No. 4. Is a more pointed form than the type, narrowing from the first whirl. About the size of the type, with margin and aperture similar, but the striations, excepting on beginning of upper whirl, near margin, are reduced to irregular lines of growth, which are prominent only in places, leaving the shell quite smooth and polished in spots. The fleckings are massed in blotches and are very dark in color, contrasting with the creamy surface. This form is very rare. I found five only among some banyan trees that stand on the top of a little hill in the cemetery, near an old ruin.

No. 5. Rather singularly there is a form of S. curtissii on Spotter's Key, a little islet lying in the middle of Nassau harbor, distant from the cemetery about a third of a mile. This islet was

formerly fortified, as the remains of old ramparts testify, and although now it is seldom visited, there must have been constant communication between it and the main island in former times. It was then doubtless that Strophia curtissii was introduced. Since then it has changed considerably. In fact, it has become one of the most interesting forms of the genus that I have seen. The form and color does not differ exceedingly from those of the type, but the size is somewhat smaller (.87 by .40). The margin is pushed forward almost to the outer diameter of the shell (in some specimens beyond this), and has become very thin. But the most important feature is the tooth, which is at least three times as long as high. (See Fig. 34 a, where I give a cut of this tooth, side and top view, and compare with ib. b, where is given a view of the type, S. curtissii). The striations are quite regular and arranged in lines.

Were it not for the fact that not every specimen on Spotter's Key has the tooth elongated to the extent shown in the type, I should not hesitate to consider this well-marked form as a species. I have elsewhere shown that on wind-swept islands, like the Caymans, species of Strophia have elongated teeth, in order that the animal may have better control over its shell, as it has no muscular attachment to it; and here on this little key, lying as it does in the middle of the harbor, the form I have just described, has, through the progress of evolution, acquired a similar tooth to those which characterize the Cayman Strophias.

Young specimens of Strophia curtissii have the central tooth missing, but with the upper well developed. There are, however, no other teeth whatever, as is usual in some other species.

Known from the closely-allied S. thorndikei by the larger size, less creamy color and thicker margin to the aperture.

From other of the short-toothed Strophias which occur on New Providence and in its vicinity, in which the central tooth is only twice as long as high, this species may be distinguished by the fleckings, combined with usual absence of the upper tooth. Occasionally this is present, but is then very minute but oftener the prominence given in the type is not even seen.

I have named this beautiful Strophia for my friend Mr. George F. Curtiss, to whom I am not only indebted for many acts of kindness when he was with me, but also for ready sympathy and encouragement in all my pursuits.

This common Strophia has found its way into collections under the

name of S. zebra of Reeve, but this is not the S. zebra described by him and figured by him in his monograph. The true S. zebra is a shell without striations, but with lines of growth only, and with the markings massed together in large, prominent blotches. My friend, Mr. F. C. Browne, has some Strophias in his collection, labelled as coming from the west coast of Andros, which answer to Reeve's figures and description of S. zebra quite nicely. Unfortunately Reeve says his S. zebra came from the Bahamas, without giving direct locality.

HABITS AND DISTRIBUTION.

The first specimen of S. curtissii, that I ever saw was gathered by Mr. Curtiss from some bushes which grew near the western border of the pond that lies to the eastward of the city of Nassau and which is known as Waterloo. Here they are scattering and are mostly confined to the south side of the road which goes out to the beach near the old magazine, but I found a few dead shells west of this road.

Later we found the type locality, which was in the cemetery between Waterloo and the city. On the north side of this enclosure is the type locality. On the hill in the middle of the cemetery among the fig trees I found a sub-species (S. c. nivea) and to the eastward of a path crossing the cemetery, another species, S. thorndikei. On the hill was also the smooth form, No. 4, and in the valley beyond it a similar form to that found at Waterloo (No. 2) already described. Outside the cemetery wall to the westward I found a few, also large, coarsely-striated specimens. I could not trace them south of the southern wall of the cemetery, nor even quite to the wall. They are exceedingly abundant in the type locality, which occupied about a quarter of an acre. Here the bushes, to which they had evidently been clinging, had been cut down, and many of the shells were upon the herbage. In other places, especially toward Waterloo, they were clinging to shubbery; all were hybernating when we found them early in March, and they were often gathered together in clusters. When taken into the house they began to move about, after a time, but in most cases refixed themseves either to one another or to the sides of the boxes, in which they were kept.

The elongated form, No 3, occurs between the type locality south and the top of the hill and a little beyond it. Numbers 1, 2, and 3, are about equally common, each representing about one per cent. of the type form, but No. 4 is very rare, only five being taken.

I liberated a number of these Strophias in the yard in which we lived, on the corner of Bay Street and Kemp's Road, in order to see if they would survive, as a species, under different environment, and fully intended to have taken a lot to U Key, but failed to do so as we did not visit this key a second time.

Mr. Curtiss made an interesting discovery regarding the form which inhabits Spotter's Key, as he found three pairs which were on the ground clinging together for mutual fertilization. This was on March 27th, directly after rain.

28 STROPHIA CURTISSII NIVEA Novo.

Snowy Strophia.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, not very heavy. Striations, present. Teeth, two, and both small. Whirls, ten. Examined forty specimens.

Form of shell, a pointed cylinder, with the first whirl the largest, then the next three are successively a little smaller, after which the shell slopes rather gradually to a point, forming an angle of 45 degrees. The striations are not numerous, twenty-two on the first whirl, are not prominent, are irregular in form, and not arranged in lines; they are narrow, being about one half as wide as the interspaces between them; are smooth and rounded.

Aperture, rather small, and slightly contracted at the entrance. Lower tooth, very short, about .02 high, and about three times as long as high. It is about central in position, and is set well back from the frontal bar, about .08. The upper tooth is also set well back, and is about as large as the lower.

Margin, produced forward nearly as far as the diameter of the shell, and is inclined very slightly to the right, the edge is very thin, about .02, and is produced upward into a sharp edge, but not rolled backward. The frontal bar is not very prominent, and the striations appear within it. Color, externally, pure white without fleckings; within the aperture, slightly tinted with flesh color.

DIMENSIONS.

Size of type, .90 by .37. Largest specimen, I.06 by 47. Smallest, .82 by .38. Greatest diameter, .47; smallest, .35. Longest specimen, 1.06; shortest, .87

OBSERVATIONS.

Variations are chiefly in color.

No. 1. Pure, snowy white without tinting of any kind, within or without. Striations even smaller than in the type and fewer; a single specimen of this beautiful form was obtained.

No. 2. Flecked slightly with pale reddish, and with more numerous and more prominent striations. Shell, thicker and heavier, with a thickened margin.

From this flecked form specimens grade, but through a very small percentage, into typical S. curtissii, hence I have not given the form full specific rank, as it is an example of an incipient species which has not become fully fixed. Known from all other Strophias by the short, central tooth and peculiar snowy whiteness.

DISTRIBUTION AND HABITS.

I found the Snowy Strophia clinging to the trunk and limbs of the banyan tree which stands near the old ruin in the cemetery, where Strophia curtissii is found. The back of the banyan is nearly white and the shell has assumed a protective color, and, as in most cases where a light form of Strophia has become evolved from a dark form, the shell has become thinner, thus reducing the size of the striations snd margin of the aperture. This lightening of the shell must prove beneficial to the animal in living on trees, but in spite of this, we find that in order to assist the animal to maintain control over its shell the upper tooth has not only beoome more prominent, but the aperture is contracted and its margin is extended forward.

No one can doubt the originator of this form of Strophia, as it is now easy to trace it back to its ancestor, and the lesson that it teaches us is of great importance in our studies of land shells, more especially of this genus. Strophia curtissii is a speeies which lives very near the ground, in fact, is frequently found on the ground, hence is liable to injury from many causes. Here we find the animal protected by a moderately heavy shell, flecked to resemble the mottled bark of trees and parti-colored herbage on which it lives. Some offspring of this mottled form ascends a white-barked tree, where they are no longer in danger of being crushed by the feet of passing animals, but are exposed to another class of dangers. Hence gradually through successive generations the animal secretes a shell better suited to its new method

of life. First, it loses its color, then the shell grows thinner and lighter, but in order that the animal may grasp it more firmly and prevent its being blown away during the prevalent tempests which occur, when the Strophia must be actively moving about, in August and September, for there is considerable rainfall in both these months and mollusks of this genus move in damp weather, a tooth is developed, which is not usually found in the ancestor, S. curtissii, namely the upper, and the aperture is narrowed and its margin pushed forward. These are apparently slight alterations, but they mean much to this small animal, and are as comparatively important to it as more easily seen changes in other and larger animals. We have seen how the form of Strophia curtissii living on Spotter's Key has altered its shell to suit its new home. Now who can say but what the animal within the shell has not changed also. At all events, an important portion of the animal has changed. Now, when I maintain that such changes after becoming fixed, as in time they do become fixed, as we find they do in many cases in this genus, constitute good and sufficient specific characters, I may be indulging in the rankest kind of conchological heresy; but is not such heresy, when, guided by facts, I apply the truths of evolution, in which every thinking naturalist believes, practically, in the naming of species, better, as indicating progression in the right direction, than conservatism, which means stagnation? I simply trace the changes which those animal are undergoing and, believing as I do, that all animals have halting places in the great system of changes, I endeavor to indicate these halting places by imposing a name upon the animal, which, assuming certain characters, has become quiescent as a form, for a time.

I once again repeat, what I have had occasion to state many times, and be it remarked I speak from a long and extended experience, that the genus Strophia is exceedingly plastic, evolving species much more readily than many genera of shells. The species are exceedingly local in distribution, and slight causes isolate colonies, that when so isolated speedily assume characters consistent with their environment, and these characters I consider, as I am forced to do, looking at the whole matter broadly and consistently, as specific. In my account of the genus Strophia I have been very careful not to overstate anything, nor have I formed any theories unsupported by facts, and as far as I have gone I have not taken any steps which I wish to retrace.

I feel constrained to make these and similar remarks, inasmuch as I know that I am looking upon the matter which I have in hand, from a

new and a widely different standpoint from which it has been viewed in the past. The correctness of my judgment may be, possibly justly, questioned, but I do trust no one will venture to pass an unfavorable verdict who has not been over the ground as completely as I have been over it, exploring those far away and often nearly desolate keys almost yard by yard, noting, and carefully recording, every attendant circumstance and surrounding that can possibly have any bearing upon the lives of these interesting mollusks. I care not what experience one has had with other genera of shells, for while it is true that this may assist him in many ways, it does not fit him to pass positive judgment upon the work of one who has had an extended experience in a genus of shells so peculiar as is Strophia. For be it remembered, it is a portion of my heresy to believe that we cannot always form cut and dried rules that will apply to all groups of any one class of animals, even though these groups be closely allied.

For an example, while we might, with perfect propriety, think a man very unscientific who would maintain that color variation, or the weight of the shell of the common Purpura lapillus, of our coast, were of the slightest specific importance, yet both of these characters (color and weight) are of vast importance, as I have repeatedly shown, in Strophia. Color, in a species of Helix (H. varia) which often grows side by side with species of Strophia, counts for nothing, specifically, as we find all gradations in this shell from pure white through a beautiful banded form to nearly black, nor is the weight of the shell of any great importance (although it may be somewhat so) in this species, nor is it, I believe, in any members of this genus. Why color should be important and protective in one group, and not in another, is difficult to say, bnt so it is. Nearly black specimens of the Varying Helix may be found side by side with white examples. Weight of shell means more with Strophia than with Helix as one animal (Helix) has a muscular attachment and the other (Strophia) has not; thus members of the genus Strophia, with a changed weight of shell, naturally are obliged to assume other vital characters which need not be assumed by a Helix when it changes the weight of its shell. Hence one may be well posted in regard to all the changing ways and characters of even so closely an allied genus as Helix and yet know very little of the peculiarities of the members of the genus Strophia.

But I think I have now said enough to convince any one that he ought, at least, to pause before giving an adverse opinion of my statements until he has seen as many of the members of the genus Strophia in their native islands as I have.

I did intend to leave much of the matter that I have given in these somewhat lengthy digressions, until I came to my general conclusions, after going completely through with my monograph, for I have been greatly encouraged by the confidence which many have shown in my work, especially among the rising generation of naturalists, but as I have read, here and there, some occasional allusions to my opinions in which the authors quite evidently judged me upon too general grounds, without looking into the heart of the matter, I thought it best to make these explanations. I now, however, will say that I have done, and shall make no more digressions of this nature until the completion of my work. This I will say, however, before quite ending the subject, should there now remain one doubting Thomas who still thinks that there should be given today no more species of Strophia, for example, than are given by Reeve in his monograph (some twenty-five, I think), and that I have been too expansive in my number of species, I now most cordially invite him to accompany me on my next trip to the Bahamas, which will probably be next spring, or on any following trip, and I will venture to say that I will show him more things in the genus Strophia than he ever dreamed of in his wildest philosophy.

STROPHIA THORNDIKEI Novo.

Thorndike's Strophia.

FIG. 34, D, front view of type.

DESCRIPTION.

SP. CH. Size, small. Shell, rather thin and light. Striations, present. Whirls, nine. Examined, 2,000 specimens.

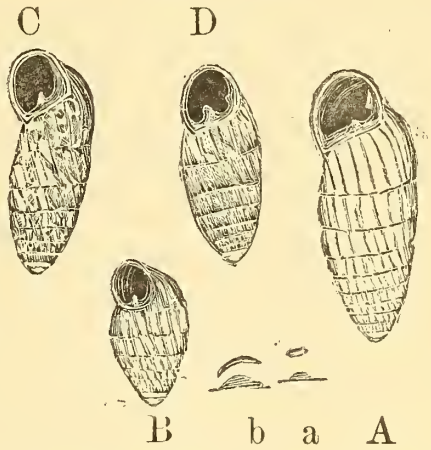
Form of shell, inclined to be cylindrical, the first and second whirls being about equal in diameter, and the third is but little smaller, then the shell slopes rather quickly to a blunt point, forming an angle of about fifty degrees. The striations are rather numerous, twenty-one on the first whirl, not prominent, rather regular, and arranged in lines; they are slightly inclined from right to left, are rather wide, hence are about as wide as the interspaces between them; they are not furrowed but are smoothly rounded.

Aperture, quite small, inclined to be rounded, and is slightly contracted at the entrance. Lower tooth, quite prominent, .05 high by about .12 long, is set well back, .08, is somewhat elevated and is

placed a little to the right of the center. The upper tooth is well developed, being about half as high as the lower, but extends backward and makes a turn around the column.

Margin, produced forward nearly as far as the diameter of the shell, and is very slightly inclined to the right, but not beyond the diameter of the shell; it is thin, about .02 is not produced backward, but ends in a blunt edge, about the middle of its width. The frontal bar is well developed and completely interrupts the striations which do not appear within it.

FIG. 34.



A, Strophia curtissii nivia, front view of type. D, Strophia thorhdikei, front view of type. B, form No. 3, S. thorndikei, front view. C, form No. 4, S. thorndikei, front view.

Color of shell, externally, reddish white, flecked with longitudinal markings of reddish brown; internally, rather pale brown, fading into creamy white on the margin and frontal bar. Apex, horn color.

DIMENSIONS.

Size of type, .70 by .30. Largest specimen, .95 by .36; smallest, .52 by .30. Greatest diameter, .38; smallest, .27. Longest specimen, .95; shortest, .52.

OBSERVATIONS.

Individual variation from the type locality seems to consist in color mainly, some being more flecked, as in S. curtissii, and in size, the largest approaching even typical S. curtissii, and are probably reversions toward that species but they maintain the nine whirls, thin margin and other characters given above. There are the following well-marked forms:

No. 1. Form, size, and markings similar to those of the type, but the margin is heavier and the upper tooth is absent, but the lower is elongated as in the type. Found around the borders of the type colony, and constitutes about one quarter of all the specimens collected.

No. 2, differs from the type in being unflecked, the color being reddish white, in having the striations smaller and more numerous,

twenty-seven to the first whirl ; but, rather singularly, the margin is heavier. The size is a little larger than that of the type, .80 by .35. The central tooth is greatly elongated, being three times as long as high, bnt the upper tooth is absent. Specimens vary a little, some being larger than the type and some show slight fleckings, others have the upper tooth. I have remarked that the bushes in the cemetery where this shell is found had recently been cut down and left on the ground. Thus it was impossible for me to tell whether this unflecked form occurred on them, but I should judge that it might have lived above the ground before it was distributed. As I could not assign a locality for it I have given it as a form only of S. thorndikei.

No. 3, is a remarkable form of shell. Short, shell with eight whirls only. top shaped, with the upper whirl the largest, and with the aperture nearly oval with the lower tooth central in position (see fig. 34, D, front view. The size is very small, .52 by .30, and the fleckings are about as in typical thorndikei. I found this dwarf form in the very midst of the colony of S. thorndikei, but living on the ground, and among them were mingled some typical S. thorndikei. There were about one per cent. of both Nos. 2 and 3 in proportion to typical S. thorndikei.

No. 4 is a slender, cylindrical form with the first three whirls equal in diameter and the margin thrown well over to the right, the upper tooth missing, and the frontal bar is oblique and inclined to the right; very dark in color, with heavy fleckings, and the color within is also very dark brown. Although I have but a single specimen only of this form I have considered it remarkable enough to mention. Fig. 34, D.

No. 5. Of the form and size of the white form, No. 2, but pale brown throughout, slightly flecked on the striations with white. I have a single specimen only of this form, but mention it as it is remarkable.

HABITS AND DISTRIBUTION.

There is a path which crosses the cemetery from the entrance that is quite frequently used, and thus being kept free from herbage, it forms a kind of barrier which prevents a mollusk like Strophia from crossing readily. S. curtissii occupied the land to the west of this path, but midway between the gate of the cemetery and the hill of which I have spoken in the account of the preceding species I found the colony of S. thorndikei, but to the eastward of the pathway which thus isolated them from the Strophias on the western side.

Most of these shells were on the ground or on the grass near it and occupied in all about one hundred square yards, being thus extremely limited in distribution. The colony had recently been much disturbed by the cutting of the bushes over and about it and some specimens had been thrown across the path, thus it was difficult to trace out the location of the various forms. Thorndike's Strophia was quite abundant in this place, but I could not trace it elsewhere and am sure that it did not extend its range beyond the borders of the path to the westward, nor beyond the cemetery wall to the eastward, and not over ten yards north and south. All specimens were hybernating when we found them.

I have named this species for Dr. T. W. Thorndike, of Boston, an enthusiastic naturalist, who accompanied me on the expedition to the Bahamas.

30 STROPHIA CINEREA Novo.

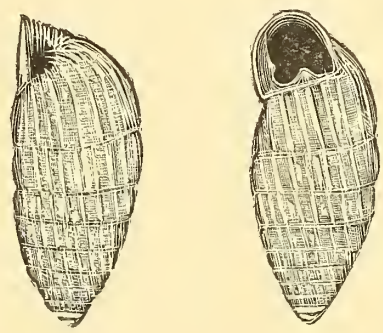
Cinerous Strophia.

Fig. 35. A, front view ; B, side view, both of the type.

DESCRIPTION.

Sp. ch. Size, rather large. Shell, not very thick. Striations, present. Animal, dark brown in color. Whirls, ten. Examined 2,000 specimens.

Fig. 35.



A B

Strophia cinerea. B, front view of type. A, side view of the same.

Form of shell, cylindrical, the first three whirls being about equal in diameter, the fourth is but little smaller, then the shell slopes abruptly to a blunt point forming an angle of sixty-five degrees. The striations are quite numerous, twenty-five on the first whirl, rather prominent, regular, arranged in lines, slightly inclined from right to left and a little narrower than the interspaces between them ; they are not furrowed, but are rounded and smooth.

Aperture, rather small, rather open, but narrows quickly from the entrance. Lower tooth, not prominent, short, about .04 high, a little more than twice as long as high, and its position is about central, but

quite near the frontal bar, about .07 ; it is not elevated ; the upper is represented by a slight protuberence.

Margin produced forward as far as the diameter of the shell, slightly inclined to the right a trifle beyond the diameter of the shell, is thickened only on the left side, and here but slightly, about .03. On the right it is reduced into a sharpened edge that projects forward ; on the left the margin is smoothly rounded, but behind it is developed a roughly sharpened lateral edge. The frontal bar is narrow but prominent, projecting well forward, completely interrupting the striations.

Color of shell, pale brown, somewhat mottled with white, but with the striations ivory white. Internally, light brown, becoming a little paler on the margin.

DIMENSIONS.

Size of type, 1.15 by .45. Largest specimen, 1.15 by .49. smallest, .83 by .37. Greatest diameter, .50 ; smallest, .36. Longest specimen, 1.23 ; shortest, .83.

OBSERVATIONS.

There is considerable individual variation even in the type locality of this Strophia, and, judging from my past experience with this species, which extends over a period of about ten years, there is some danger of the type form becoming extinct. Of this matter, however, I shall be able to speak more positively, I trust, in my next instalment of this Monograph, the inclinations being to a form with coarser striations and fewer of them. There are also three decided forms which are as follows :

No. 1 is a small form, .83 by .37, with numerous striations, twenty-nine to the first whirl ; aperture, more contracted, with a thinner margin and with the color white, slightly mottled with very pale brown. This form occurs in the type locality, and forms about fifty per cent. of the whole number found.

No. 2 is about the same size and form of the type but much darker in color, the interspaces being dark brown, and the striations pale brown ; the interior is also dark brown, pale on tooth and margin, nearly white on lower side of frontal bar. The striations are narrower, being about one half the width of the interspaces. This form occurs along the beach of Middle Bay, Hog Island, east of the type locality, and is not very common, being about five per cent. of the type form.

No. 3 is a heavy shell, shorter and thicker than is the type, 1.10 by .40, with a thick double margin (.10), short, prominent central tooth and very narrow projecting frontal bar. The shell is white, mottled with very pale brown. Of this singular form I have two only, and they came from the northward of the type locatity.

Strophia cinerea may at once be distinguished from all other members of the genus by the thin margin, thickened slightly to the left, which is produced well forward, cylindrical form and peculiar color. No other Strophia, with which I am familiar, combines these characters in one species.

This species, being from an accessible locality, is quite common in collections, but in all of the cases where I have seen it labled it has erroneously borne the name of some of the older species which are from widely different localities.

The species has been known for many years, and we find it figured by Edmund A. Crouch, in his introduction to Lemarcke's Conchology, in 1827, plate XV, No. 2, as S. mumia! (See remarks regarding this on page 194 of Vol. I..)

HABITS AND DISTRIBUTION.

This singular and interesting Strophia occurs on Hog Island, along the shore of Middle Bay, which is on the south side of the key. The shells are found either on the ground or attached to the stems of low bushes not far above the ground. I traced them about a hundred yards along the bay in either direction; to the eastward they straggle out somewhat and grow into form No. 2, but to the westward terminate more abruptly, and do not occur far up the slope of the hill, which lies to the northward, excepting as stragglers, to be mentioned under head of the next sub-species.

31 STROPHIA CINEREA ROBUSTA Novo.

Robust Strophia.

Fig. 36, A, front view; B, side view of type.

DESCRIPTION.

Sp. Ch. Size large. Form robust. Striations, present. Whirls, nine. Examined, seventy-five specimens.

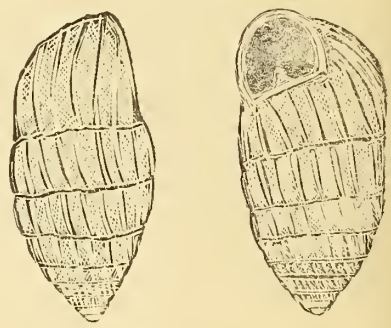
Form of shell, conical; the upper whirl being the largest, and each successive whirl smaller in regular proportion to the fourth,

where the shell slopes abruptly to a blunt point, forming an angle of sixty-eight degrees. The striations are not numerous, twenty-three to the first whirl, are rather prominent, quite regular, but not arranged in lines, nearly straight on the first four whirls, but are slightly inclined from right to left on the lower whirls; they are not furrowed but are smoothly rounded, and are about as wide as the interspaces between them.

Aperture, small and contracted at the entrance, measuring a little more within than at the margin. Lower tooth, quite prominent, about .04 high, less than twice as long as high; it is slightly elevated. The upper tooth is about as high as the lower, and extends backward around the column.

Margin, not produced forward as far as the diameter of the shell, is slightly inclined to the right, but not beyond the diameter of the shell, but the upper whirl bulges out from it on the left, about half the width of the aperture. The margin is not thickened, and the only lateral projection from it is on the left, and that is slight. The frontal bar is thin, but interrupts the striations.

FIG. 36.



B A

Strophia cinerea robusta. A, front view, B, side view, of type.

Color of shell, externally, ashy brown, with the striations creamy white. Internally, dark-brown, creamy white on edge of margin and on teeth.

DIMENSIONS.

Size of type, 1.12 by .55. Largest specimen, 1.37 by .50; smallest, .97 by .30. Greatest diameter, .55; smallest, 30. Largest specimen, 1.25; shortest, .97.

OBSERVATIONS.

Individual variation is considerable, but is mainly toward a cylindrical form with a thickened margin through which this subspecies intergrades with typical S. cinerea. but through a small percentage of specimens, some of which have ten whirls. The margin of some specimens is also thickened. A decided form is as follows:

No. 1, smaller, 1.00 by .50. Whirls, still nine, but with the striations much more numerous, 26 to the first whirl. The upper tooth is not as prominent, and the color of the shell is paler.

The Robust Strophia may be distinguished at once in the type form from S cinerea by the nine instead of ten whirls, but there is, as stated, some gradations toward the parent stock.

HABITS AND DISTRIBUTION.

The Robust Strophia occurs on the north side of Hog Island among some dwarf palms that grow directly back of the beach ridge from a sandy soil. They are found clinging to the palm stems or leaves. The situation in which they are found is rather sheltered and the thickened shell has doubtlessly been evolved as a protection against the dryness and heat of the sand among which they live. The lack of any extended margin in both this and the parent stock would seem to indicate that the animal did not protrude itself as far from the shell as is usual in some other allied species.

The small form, No. 1, occured beneath palm leaves in groups of five or six, but neither form were abundant.

One of my chief reasons for considering this form as a sub-species only, is that I found an occasional specimen of typical S. cinerea, scattered along a path which led directly from the beach to Middle Bay, on the south side of the island, which is the home of the Cinerous Strophia. These shells are doubtlessly transported accidentally by persons who pass along the path, and thus as the colony of S. robusta receives an occasional recruit from the parent stock, direct intergrades occasionally occur.

32 STROPHIA CINEREA TRACTA Novo.

Mottled Strophia.

FIG. 37, A, front view of type.

DESCRIPTION.

SP. CH. Size, about medium. Shell, rather thin. Striations present. Whirls, ten. Examined, 300.

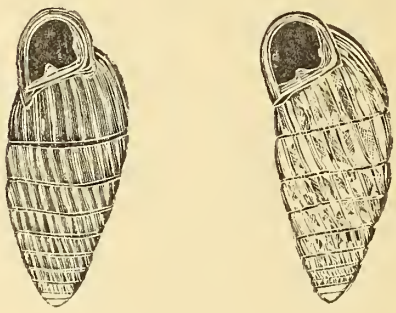
Form of shell, a pointed cylinder, the first whirl being the largest, then each successive whirl is a little smaller than that above it, to the fifth whirl, when the shell slopes to a rather acute point, forming an angle of fifty-eight degrees. The striations are rather

numerous, twenty-six on the first whirl, are not prominent, are quite regular, but not arranged in lines. They are very smooth, not furrowed, and just about as wide as the interspaces between them.

Aperture, rather small, a little contracted at the entrance. Lower tooth small, about .03 high, not as long as high, and but slightly elevated, and is about central in position. The upper tooth is represented by a slight protuberance.

Margin, produced forward about as far as the diameter of the shell, is very slightly inclined to the right, a trifle beyond the diameter of the shell, is slightly thickened, measuring about .04, and while the posterior portion is produced backward into a blunt edge, it is not rolled over. The frontal bar is narrow, yet interrupts the striations, which are, however, slightly indicated within.

FIG. 37.



B A

A, Strophia cinerea tracta, front view of type. B, Strophia cinerea mutata, front view of type.

Color of shell, creamy white, beautifully mottled and flecked with yellowish brown and umber, the markings often crossing the striations. Within, deep umber brown, paler on the central tooth and fading rather abruptly into creamy white on the edge of the margin.

DIMENSIONS.

Size of type, 1.05 by .45. Largest specimen, 1.02 by .47; smallest, .75 by .37. Longest specimen, 1.25; shortest, .75. Greatest diameter, .47; smallest, .37.

OBSERVATIONS.

While the type form preserves its identity, and prevails in numbers, this is one of the most unsettled forms of Strophia that I have seen, as it has developed no less than five distinct forms, besides a small percentage of specimens showing complete gradations with typical S. cinerea. The forms are as follows:

No. 1. A long cylindrical form, with the first three whirls equal in diameter. Otherwise as in the type. Size 1,25 by .42.

No. 2. A color form nearly white, or with a few pale mottlings, otherwise as in the type.

No. 3. Form and size about as in the type, but very dark brown throughout, with white striations, which are more numerous, being twenty-five or more.

No. 4 is a small form, .75 by .37, with nine whirls only, but the margin is considerably thickened, and the color pale, with few or no fleckings. Nos. 1, 2, and 3 are not very common, constituting about three per cent. of the whole; of No. 4 there are about six per cent.

No. 5 is the most remarkable of all, being pure ivory white in color, externally and internally, with a thickened margin (about .07), and open aperture. Striations coarse and flattened, twenty to the first whirl. Both teeth are very prominent. Size, 1.00 by .37. This form recalls No. 3 of S. cinerea, but is smaller, heavier, and whiter. I have four shells only, and did not three of them show some gradations toward form No. 4, I should not hesitate to pronounce it a distinct species, as it is very far removed from the type. Further investigations in the neighborhood of the type location of S c. tracta may reveal a fixed locality for this shell.

HABITS AND DISTRIBUTION.

I found the Mottled Strophia quite common in a very restricted location on the borders of a field, that is situated nearly on the extreme eastern point of Hog Island. Here they were clinging to the grass and herbage, but I did not then observe any fixed location for the various forms. I should judge that the form was of quite recent origin, and has not yet become settled.

33 STROPHIA CINEREA MUTATA Novo.

Changing Strophia.

Fig. 37, B, front view.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, rather thick. Striations, present. Whirls, ten. Examined 100 specimens.

Form of shell, a pointed cylinder, with the first whirl the largest, then each successive whirl is slightly smaller than the one above it, as far as the fifth whirl, when the shell slopes gradually to a point, forming an angle of fifty-seven degrees. The striations are numerous,

thirty on the first whirl, are small, slender, and regular, but not arranged in lines; they are slightly inclined from right to left, are not furrowed, but are smooth and rounded and a little more than one half as wide as the interspaces between them.

Aperture, rather small, and considerably contracted at the entrance. Lower tooth, not prominent, about .04 high, and about twice as long as high; it is not elevated, and is set back about once its length. The upper tooth is represented by a mere tubercle.

Margin produced forward nearly as far as the diameter of the shell, and is very slightly inclined to the right, a trifle beyond the diameter of the shell; it is thickened all around, hollowed out in the middle, and then projected backward into a sharp edge, which is not rolled over. The frontal bar is very thin and completely interrupts the striations.

Color of shell, deep umber brown, with most of the striations creamy white. Brown within, becoming creamy white on the edge of the margin and frontal bar.

DIMENSIONS.

Size of type, 1.15 by .40. Largest specimen, 1.14 by .50. smallest, .88 by .38. Greatest diameter, .50; smallest, .38. Longest specimen, 1.25; shortest, .88.

OBSERVATIONS.

Individual variation consists of gradual gradation into a smaller form, on one hand, with rather less number of striations, twenty-five on first whirl, and on the other, to a larger, thicker form with more numerous striations, thirty-seven on the first whirl, but there is no decided form among these.

No. 1. The only inclination to assume a form is, singularly enough, one which grades directly into typical S. cinerea. In fact, at one extremity of this form we have a cylindrical shell much like typical S. c. mutata, and at the other, shells which I confess I cannot distinguish in the smallest particular from typical S. cinerea.

The presence of this singular sub-species of S. cinerea on Long Key was a great surprise to me, the more so, as on Spruce Key, an island only about a half mile to the north of Long Key, I found two distinct species, not only different from anything on either Hog Island or on New Providence, but varying widely from one another.

Typical specimens of the Changing Strophia are very beautiful and so utterly different from S. cinerea that no one would suspect the relationship, but that, too, as stated, complete gradations occur between the two. I do not hesitate to affirm, however, that this species is of quite recent origin and that it has not had time to completely change. My reason for making this statement is mainly because I could not find any dead specimens of any forms on the ground, as is the case among old established species. This is also true in regard to the Mottled Strophia.

How long it takes to evolve a form of Strophia with characters so widely different as those exhibited by this one, it is difficult to say, with our present knowledge of the subject. I should think, however, that these mollusks, when placed under a widely different environment from that under which they had been living, would begin to change in two or three generations; but what the length of the life of a single individual is, and how long it is in coming to maturity is impossible to say. Judging, however, from the fact that in the winter it is so difficult to find a young Strophia with less than four whirls, that, with all my experience, I never saw a specimen with less than this number, it is probable that they grow quite rapidly, especially in summer, and probably acquire their full size in one year. Twenty years would mean much to a colony of Strophia, and would naturally produce many changes, while in a hundred years I should think that many species would grow old and become extinct.

Be these matters, which are, after all, somewhat speculative (but not, perhaps, as much as they seem) as they may, here we have in this Strophia a fine example of the changing of one species into another, and also very clearly shows how careful we, of to-day, must be in recording all the steps of change in order that future generations may benefit by our researches.

The typical Changing Strophia may be at once recognized by the dark color, white, and numerous striations.

HABITS AND DISTRIBUTION.

I found the Changing Strophia on March 29, 1893, clinging to shrubs along the rocky, northern shore of the western half of Long Key, an island that lies about a mile east of Hog Island. I traced the shells westward along the shore as far as the little bay on which the Marine Hospital stands and eastward to a sand beach about midway

on the key. They were not found more than a few yards back from the water's edge. As the weather had been very dry all of the shells were fixed and hybernating.

34 STROPHIA ALBEA Novo.

Pink Strophia.

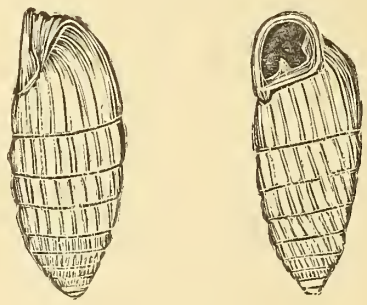
FIG. 38. A, front view; B, side view of type.

DESCRIPTION.

SP. CH. Size, rather small. Shell, quite thick and heavy. Striations, present. Whirls, nine. Examined forty specimens.

Form of shell, a pointed cylinder, the first whirl being the largest, then each successive whirl is a little smaller to the fourth whirl, then the shell slopes gradually to the top, forming an angle of forty-five degrees. The striations are numerous, twenty-five to the first whirl, are not prominent, but are very regular, appearing like little half cylinders laid against the shell; they are thus rounded, and are highly polished, without any furrows whatever, and are about one half as wide as the interspaces between them.

FIG. 38.



B A

Strophia albea. A, front view, B, side view of type.

Aperture rather small, slightly contracted at entrance, and rather oval. Lower tooth prominent, about .04 high, and twice as long as high; not elevated, and set back about once its length from the frontal bar. Upper tooth quite well developed.

Margin produced forward about as far as the diameter of the shell, is thickened all around, measuring about .03, is grooved, and the posterior portlon is produced into a deep edge which is not rolled bpckward. The frontal bar is comparatively thin, but completely interrupts the striations.

Color of shell, dark flesh color throughout boty, externally and internally, extending also over the striations, paler on the apex and margin, with no indications of fleckings or markings of any kind.

DIMENSIONS.

Size of type, 1.00 by .36. Largest specimen, 1.10 by .37; smallest, .81 by .36. Greatest diameter, .45; smallest, .36. Longest specimen, 1.10; shortest, .81.

OBSERVATIONS.

There is but little variation in this delicately-tinted Strophia, either in form, color, or size. The peculiar flesh-colored tint recalls at once the color of Strophia nuda, described in Vol. I, of these Contributions, but that shell was smooth and of quite a different form. I know of no other Strophia which exhibits this singular color.

HABITS AND DISTRIBUTION.

I found Strophia albea on the south side of Spruce Key (See fig. 40), clinging to the scanty shrubbery that grows from the naked rock on this nearly desolate little island. It evidently forms an example of a nearly extinct species for, although, in company with Mr. Curtiss I searched with great care, but three living specimens were obtained on the entire key, yet the ground was strewn with dead specimens, many of which showed marks of having been on the rocks for years.

35 STROPHIA CORYI Novo.

Cory's Strophia.

FIG. 39, A, front view, B, side view of type.

DESCRIPTION.

SP. CH. Size, medium. Shell, quite heavy. Striations, present. Whirls, ten. Examined, 2,000 specimens.

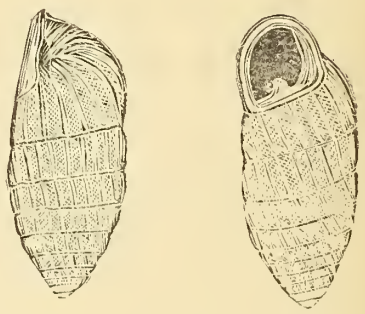
Form of shell, quite cylindrical, the first three whirls being about equal in diameter, the fourth is but little smaller, then the shell slopes to a rather blunt point, forming an angle of fifty-five degrees. The striations are not numerous, nineteen to the first whirl; they are not prominent, very regular, not furrowed, but rounded, narrow, are about half as wide as the interspaces between them, but are not arranged in lines, and very slightly inclined from right to left.

Aperture, quite small and rather contracted. Lower tooth, quite prominent, about .04 high, and about twice as long as high, nearly

central in position, a little elevated, and set back about once its length. The upper tooth is about half as high as the central, is placed low, being but little above the top of the lower tooth.

Margin, produced forward as far as the diameter of the shell, is slightly inclined to the right, a trifle beyond the diameter of the shell. It is considerably thickened (.07), with the edge projected backward, and shapened, but not rolled downward. The frontal bar is quite well developed, and interrupts the striations, which are, however, slightly indicated within it.

FIG. 39.



B A

Strophia coryi, A, front view, B, side view, of type.

Color of shell, externally, deep ashy brown, with the striations creamy white; internally, also brown, a little paler than on the outer surface, becoming creamy white on the tooth, margin and frontal bar.

DIMENSIONS.

Size of type, 1.00 by .40. Largest specimen, 1.12 by .42; smallest, .62 by .36. Greatest diameter, .45; smallest, 36. Largest specimen, 1.12; shortest, .62.

OBSERVATIONS.

The type form is very abundant, proportionately, and there is comparatively little variation that can be considered as purely individual. What little there is consists in a thinner or thicker margin, and slightly finer or coarser striations, but there are five distinct forms developed, which are as follows:

No. 1 is an elongated cylindrical form with the first four whirls equal in diameter, and a thinner margin. This form grades directly toward S. cinerea, and I have three specimens that are direct reversions toward that species. Size, 1.10 by 1.36.

No. 2. This is a singular form, nearly pure white in color, shorter, with nine whirls only, faintly yellowish within, and slightly tinted with brownish between the striations. Size, .97 by .47. This form recalls the white No. 3, which has been evolved from S. cinerea

No. 3 is a form with more numerous striations, twenty-four to the first whirl, and they are finer, the shell is darker, with dark umber blotches, which often cross the striations.

No. 4. A short form, with nine whirls, and, excepting this, is a miniature of the type. Size, .76 by .36.

No. 5. The smallest of all, with a very thin margin and with numerous striations, 30 to the first whirl, and the color, without and within, is much paler than in the type. Size, .65 by .37.

This last form is almost sub-specific, but there still remain too many specimens having intermediate characters, that bind them to other forms, to so consider it.

Form No. 1 is very rare, less than one per cent. of the whole. No. 2 is more common, about .10 per cent. of the whole. No. 3 is less common, about 1 per cent.; while Nos. 4 and 5 are more abundant, and form about five per cent. of the whole.

Cory's Strophia may be known by the heavy shell, thick margin, and peculiar brown color, with the contrasting creamy white striations.

I have named this species for Mr. Charles B. Cory, the well known ornithologist, who has exhibited considerable interest in West Indian shells, especially in the genus Strophia.

HABITS AND DISTRIBUTION.

Cory's Strophia is an abundant species on the extreme west end of New Providence, and is found clinging to bushes and herbage that grow along the bay. I traced it northward as far as the open grounds which lie about the single house that stands on this bay, and southward as far as the bushes extend, and eastward to the pine woods.

In regard to the locality occupied by the forms, I cannot speak with certainty, as I did not collect all of the specimens which were procured, and, in fact, had a few hours only in which to examine the locality, as we came to anchor in the bay for a short time, when we were bound for Andros.

One of the most singular things that I have to state regarding this Strophia, is the fact that I found five undoubted specimens on Spruce Key. Two of these only were living, all the rest were dead. Thus on this little key, which is only a few hundred yards long, live two species of Strophia.

We have seen that even among typical Strophia cinerea there is an inclination to evolve a white form (No. 3) and that this is quite like form No. 2, which is evolved by S. coryi. We also find that through

form No. 1 of S. coryi, there is a decided tendency to a reversion towards S. cinerea, in fact, I have two specimens which are nearly or quite typical S. cinerea. I do not hesitate to affirm with these facts in view, showing so clearly the relationship of the two species, that S. coryi, as found on the west end of New Providence, is derived from S. cinerea. Now comes the question as to where the specimens of S. coryi which I found on Spruce Key came from. Has S. cinerea evolved two colonies of S. coryi, one for Spruce Key and one for the west end of New Providence?

The presence of a species of Strophia evolved from S. cinerea on the west end of New Providence is accounted for by supposing, quite reasonably, that the parent stock was transported there by the persons who settled on the plantation which is now there, the house of which I have spoken as being near the colony of Strophia coryi.

Now in regard to the specimens of S. coryi, found on Spruce Key, it seems more reasonable to suppose, that they also were evolved directly from the parent stock of S. cinerea, possibly through form No. 3, than to suppose that they were transported from the west end of New Providence, some twenty miles away. The shells from Hog Island could have reached Spruce Key through the agency of ocean currents, as will be seen by consulting the diagrammatic chart given in fig. 40.

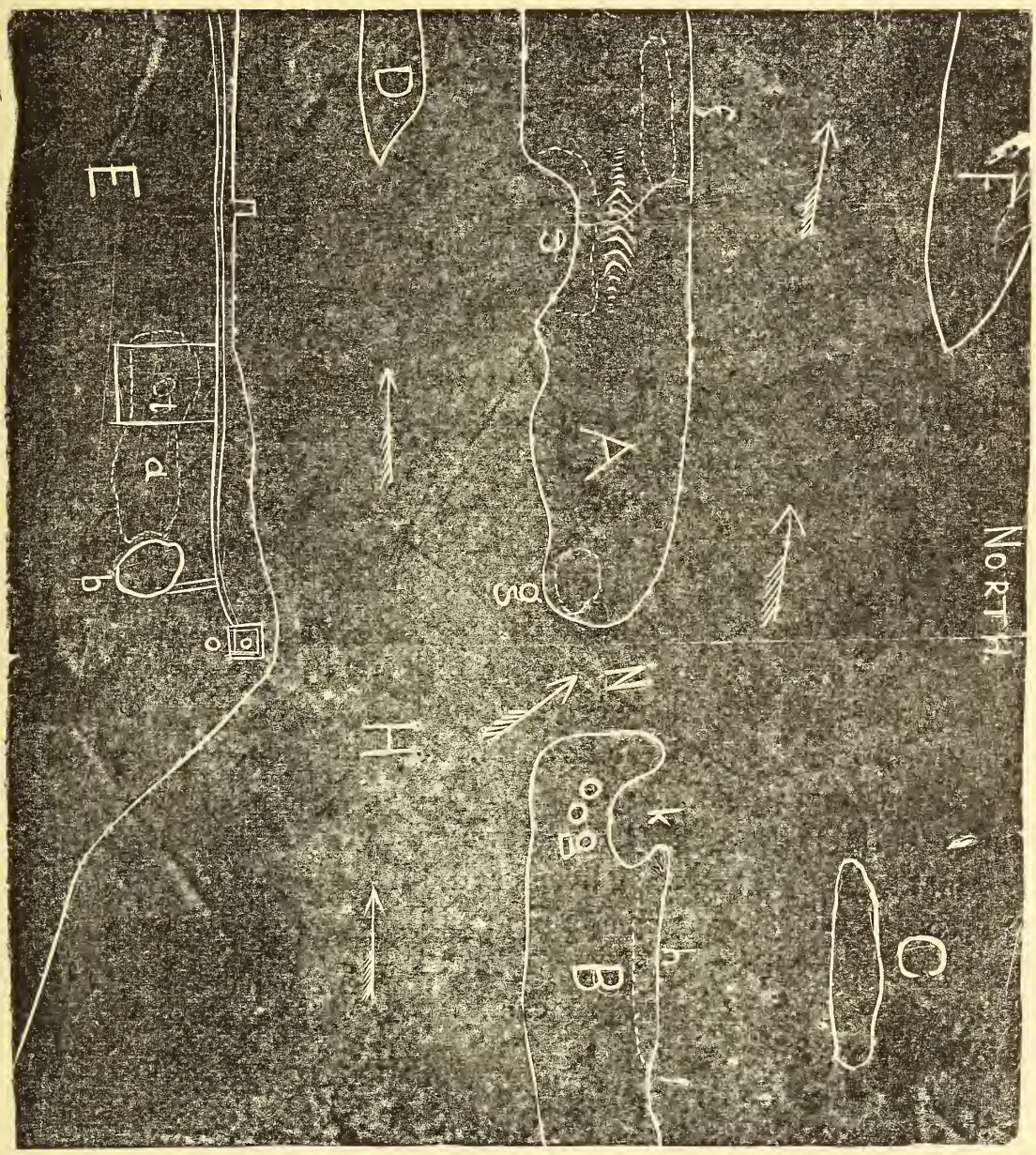
The scale of this chart is, roughly estimated, about two inches to the mile. A, is Hog Island, e, Middle Bay, the home of typical S. cinerea, C, is Spruce Key, but as the tide sets east and west through Nassau Harbor, in the ebb and flood, and north and south through the Narrows, N, between Hog Island and Long Island, B, a shell falling into the water at c, would quite possibly reach Spruce Key on the ebb tide.

In order that the reader may more fully comprehend the localities inhabited by the interesting species, sub-species and forms of Strophia, in the immediate neighborhood of Hog Island, I give the accompanying diagrammatic chart.

E, is a portion of New Providence, east of Spotter's Key. A, is the cemetery, and the locality bordered by the dotted lines, shows the range of S. curtissii, extending as far east as Waterloo, b. In the midst of these bounds, and in the cemetery, is the limited range of S. thorndikei, t.

Leaving the main island of New Providence, we cross to Spotter's Key, the eastern end of which is shown at D. This is the home of the

FIG. 40.



Diagrammatic Chart of localities inhabited by species of Strophia. A, Hog Island: B, Long Island: C, Spruce Key; D, Spotter's Key; E, a portion of New Providence; F, Salt Key; H, Nassau Harbor; N, Narrows: a, Strophia curtissii (the dotted lines indicate boundary limits); b, Waterloo; e, Middle Bay and Strophia cinerea; f, S. c. robusta; g, S. c. tracta; h, S. c. mutata; k, bay, near hospital buildings; i, sand beach; o, old magazine; t, Strophia thorndikei in the cemetery. The arrows indicate the course of the currents at flood tide.

long-toothed form of S. curtissii (No. 4).

Crossing another narrow channel, further north, we come to Hog Island, and at e, is Middle Bay, before mentioned, with S. cinerea living along its border, a widely different species from those which are found on the east end of New Providence.

Crossing the hill back of the bay, then a swampy valley, we ascend the hills which form the beach ridge and come to the scattered colony of S. c. robusta, f.

To the eastward on the southern side of the point of the island is the restricted colony of S. c. tracta, g.

Crossing the Narrows, N, which are about one fourth of a mile wide, we find the western end of Long Island, B.

[I will here remark, that, probably owing to the great extent of the Bahamas, the names of some small keys are applied to more than one island. For example, we have this name "Long" applied to no less than three different keys: one near New Providence, as now given, one near Rum Key, and one in the Crooked Island Passage, further south.]

The buildings of the hospital occupy the western end of Long Island, and to the north of them is a little bay, k, east of this bay, around the point, the colony of S. c. mutata begins, and extends to a sand-beach, midway of the key at l, thus in the chart the western half only of Long Island is given. North of the western end of Long Island is the little rocky islet known as Spruce Key, on which two distinct species of Strophia live, or did live at the time of my visit, March 29th, 1893, namely, S albea and S. coryi (see c).

At F, directly north of Hog Island, is the desolate Salt Key, which I have not yet visited, and so cannot say whether it contains any species of Strophia or not.

It is still too early in the course of my investigations to even speculate intelligently as to the probable origin, time of distribution, etc., of the various forms of Strophia found in this locality, but this chart will, I trust, prove of interest in showing the direct localities in which the mollusks of which we are treating occur.

As an interesting item in the habits of S. coryi, I have to add that since the last sentence regarding that species was written one of the type specimens contained in a box on my table has left his fellows, crawled up the sides of the box about an inch and a half, and fixed itself there. Now this specimen was taken on the west end of New Providence on April 17th, 1893, and last night, that of December 14th, 1894, it has shown signs of life. This shell has, during these twenty

months, been kept in a box, with others, and although some showed signs of life during the summer of 1893, they have, so far as I have observed, all remained quiet up to this time. Of course they have been kept in a warm room and in the drawer of a cabinet, where they have been but little disturbed. This incident is very instructive as showing the great length of time in which at least individuals, of this group of animals can live under adverse circumstances. See further remarks on this head under Strophia grayi and S. ritchiei.

36 STROPHIA RITCHIEI Novo.

Ritchie's Strophia.

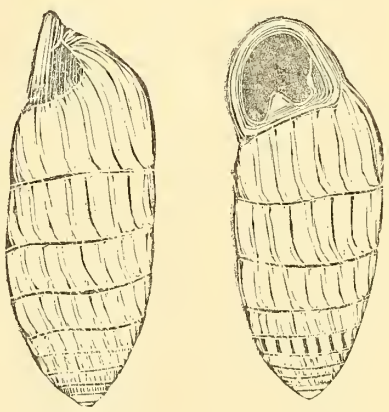
FIG. 41. A, front; B, side view of type.

DESCRIPTION.

SP. CH. Size large. Shell, heavy. Striations, present. Whirls, ten. Examined, 1,000 specimens.

Form of shell, inclined to be cylindrical; the first two whirls being equal in size and the third is but little smaller, and from this the shell slopes to a rather rounded point, forming an angle of sixty-five degrees.

FIG. 41.



B A

Strophia ritchiei, of type A, front; B, side view

The striations are rather numerous, twenty-three to the first whirl, are regular, but not arranged in lines, about as wide as the interspaces between them, and although rounded and smooth, without furrows, are not polished.

Aperture, not very small, and open. Lower tooth large and prominent, about .08 high, and about as wide at the base as it is high, and nearly one and one half times as long as high. Its position is central, and it is set back a little less than its length. Upper tooth represented by a slight tubercle.

Margin, produced forward nearly as far as the diameter of the shell, and is slightly inclined to the right, slightly beyond the diameter of the shell. It is thin and rounded, but not produced into any edge whatever. The frontal bar is extremely well developed, and so com-

pletely interrupts the striations that there is no trace of them within it.

Color of shell, dull white throughout, without markings of any kind. Within, flesh color, fading into white on the teeth and margin.

DIMENSIONS.

Size of type, 1.37 by .57. Largest specimen, 1.37 by .65. smallest, 1.10 by .46. Greatest diameter, .65; smallest .46. Longest specimen, 1.40; shortest, 1.10.

OBSERVATIONS.

The type form is very constant, pure individual variation being but slight. There is an inclination toward a more cylindrical form with the first three whirls equal, and some specimens show a slightly thickened margin, but as a rule, this is as in the type, and no thicker than the shell. The whirls vary in this form from ten to twelve. There are however, the following well-marked forms:

No 1. About the form and size of the type, but with more numerous striations, twenty-five to the first whirl. The margin is thinner, with the edge sharpened, and the aperture smaller and more contracted. The color is ashy brown, with the striations creamy white, and the color within is rather dark, purplish brown. In this form there are individuals with slightly coarser striations, 20 to 22 to the first whirl. These usually have a thickened margin and a more cylindrical form. This form is not very common, being about one per cent of the whole.

No. 2 is a small form, 1.10 by .47, but with ten whirls, and with only sixteen striations to the first whirl, and the first three whirls are equal in diameter. Otherwise as in the type.

No. 3. Cylindrical, with eleven whirls. the first three of which are equal in diameter. The striations are a little less numerous than in the type, but the margin is rounded, but not thickened. There is a slight individual tendency in this form to assume, with fewer striations, the thin sharpened margin seen in the next species, S. grayi, but I can find no fewer than eighteen striations in any specimen, therefore it is the extreme form is not typical S. grayi. These are about one half per cent of the whole of this form.

No. 4 is a remarkable form typically and, in fact, an incipient species, but with two many gradations yet to permit a consistent

naming. The general form is about that of typical S. ritchiei, but the aperture is wider and decidedly more open, but above all the striations are very numerous, thirty-four to the first whirl, and although they are narrow, they are so crowded as to be wider than the interspaces between them. The color is dull white, faintly tinted with flesh color within.

This Strophia may be readily known by the large size, white color, projecting and thin margin, with its prominent frontal bar. There is a superficial resemblance to S. alba, but alba has a wider, more flaring, margin, with the edge rolled over and sharpened, and with the frontal bar not at all well developed. The central tooth is also small in alba, and set back from the bar about twice its width. From S. grayi it may be distinguished as given under that heading.

I have named this fine, large Strophia for Mr. John Ritchie, Jr., of Boston, the well known conchologist and scientist, who, from the beginning, has exhibited the utmost interest in my work upon this genus.

HABITS AND DISTRIBUTION.

Highburn Key lies to the eastward of what is known as the Middle Ground, an expanse of shallow water about thirty miles wide that stretches out toward the Atlantic from New Providence. The key is partly divided in two by bays which break into the land north and south ,hence forms a rude letter H, with a rather wide cross bar. Both the eastern and western arm of the key are made up of hills, but those to the eastward are higher and a little wider, than those to the westward.

We entered the bay on the south of the key and landed near its head. Almost immediately upon looking about I saw specimens of Ritchie's Strophia. They were clinging to the stems of bushes and here occurred the typical form. I traced it back along the eastern hills northward for about a mile, a short distance beyond the ruins of the only building that stands on the key, and southward to the sonthern point of this division of the key, but at this point the brown form, No. 1, was more prevalent, growing in the shade of the thicker shrubbery. Westward it spreads to the front of the hills of that division of the key but is not found on them. Thus it has quite an extended range, occupying about a half of a square mile, but it is nowhere numerous, as compared with many other species of the genus.

One of the most striking features of this species appears to be its powers of endurance. I have now a number of living specimens that were collected on Highburn Key on April 8th, 1893, that have been kept in a box in my cabinet. Last summer they gave me some trouble by wandering about over the other boxes, but have not attempted to move much since, but today, December 15th, I pierced the shell of one and found the animal, which is a pale horn color, lively, and it immediately shrunk back a whirl in from the broken portion of the shell, but did not form the usual partition. Although I put both this specimen and that of Cory's Strophia, of which I have spoken, in water, yet the animals have not as yet ventured out of their shells.

37 STROPHIA GRAYI Novo.

Gray's Strophia.

Fig. 42, A, front, B, side view, of type.

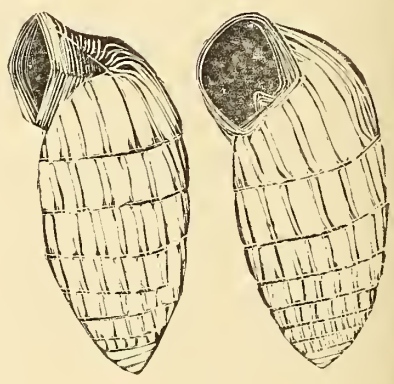
DESCRIPTION.

Sp. Ch. Size, rather large. Shell, thick and heavy. Striations, present. Whirls, eleven. Examined 700 specimens.

Form of shell, cylindrical, the first three whirls being about equal in diameter, the fourth is a little smaller; then the shell slopes to a blunt point, forming an angle of sixty-nine degrees.

The striations are not numerous, sixteen to the first whirl, are rather prominent, not very regular, and not arranged in lines; they are not furrowed, are smoothly rounded, and slightly polished: the interspaces between them are wider than they are, and furrowed with longitudinal lines of growth.

Fig. 42.



B A

Strophia grayi. A, front view, B, side view of type.

Aperture small, with the corners decidedly angular, especially below, slightly contracted at the entrance. Lower tooth quite prominent, .04 high, as wide as high, and twice as long as high; it is set very far back, .12 from the frontal bar, is not at all elevated, and is about central in position. Upper tooth absent.

Margin produced forward beyond the diameter of the shell, is inclined to the right beyond the diameter of the shell; is thinner than the shell behind it, and the edge is sharpened without being rolled over, but is much roughened on the sides by lines of growth. The frontal bar is developed to a remarkable degree, protruding far beyond the shell (.08), as far, in fact, as the rest of the margin, and has three or four lines of growth between its edge (which is thin, sharpened as in the other portions of the margin) and the striations.

Color of shell, throughout, externally, dull white; internally, deep brown, fading into white on the tooth and margin beyond it.

DIMENSIONS.

Size of type, 1.25 by .55. Largest specimen, 1.40 by .67; smallest, 1.05 by .47. Longest specimen, 1.40; shortest, 1.05. Greatest diameter, .67; smallest, .47.

OBSERVATIONS.

Individual variation is mainly in the direction of a form with fewer striations, sometimes as few as thirteen only are found. Some individuals have the upper tooth developed, then there are more striations, and the margin is thicker, with the edge smoothed and not sharpened as in the type. I regard these specimens as decided reversions toward S. ritchiei which is undoubtedly the parent stock of this species. In concluding that S. ritchiei is the older species I have been guided not only by the fact that S. grayi shows considerable reversion towards that species, but also because S. grayi appears quite unsettled, for it has not only produced three well marked forms, but two other forms which I must regard as sub-species. The three forms are as follows:

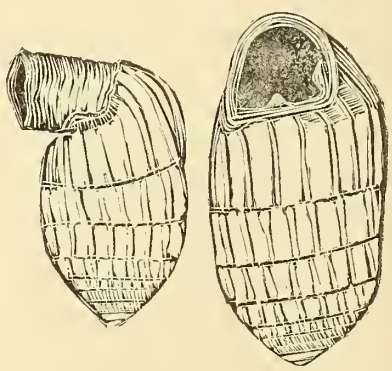
No. 1, shorter and proportionately thicker than in the type (1.10 by .57); whirls, ten, the first three of which are about equal in diameter. Margin not produced forward as far as the diameter of the shell, and with the edges slightly rounded. Striations, twenty to the first whirl. Tooth and color, as in the type, but the upper tooth is present, but small. Variations are toward producing a sub-form with a thickened margin, bnt in some cases the margin is produced forward with the edge upward. These are about one per cent. of this form.

No. 2. Also short, but more slender, 1.06 by .50. Whirls, ten. Margin not produced forward any farther than the diameter of the shell. Striations, eighteen to the first whirl. The variation in one direction is toward a sub-form, with a less number of less distinct striations and a more cylindrical shell, and on the other hand, toward a greater number of more prominent striations, but with the form typical. There are rather more than two per cent. of this form.

No. 3. A remarkable form, with a short, thick cylindrical shell, which, from the fourth whirl, slopes to a very blunt point, forming an angle of eighty-five degrees. Margin, teeth and color about as in form No. 1, excepting that the upper tooth is well developed. Striations, nineteen to the first whirl. See fig. 43, A. I have seen ten or twelve only of this remarkable form.

Strophia grayi may be at once distinguished in the type form from S. ritchiei by the coarser, fewer striations and above all by the projecting margin with its sharpened edge, which character will separate it also from all other Strophias which I have examined. In fact, in Strophia grayi this margin appears to have reached the maximum development and seems to be its strongest character. A specimen of form No 1 which has had the margin broken, has replaced it with one that measures .30 in length and which has the frontal bar projecting about .20 beyond the shell. See 43, B. It is a significant fact, that the central tooth, being no longer necessary with such a length of margin, has become nearly absorbed.

FIG. 43.



B A

A, Form No. 3, Strophia grayi. B, Deformed specimen of S. grayi.

There appears to be a great tendency among injured shells of this species to replace the broken parts with deformites, but as I intend to figure those peculiarities later, among others of other species, I will not enlarge upon them here.

I have named this species from Mr. Arthur F. Gray, of Boston, the well-known and accomplished conchologist.

HABITS AND DISTRIBUTION.

In my account of S. ritchiei, I have said that there is a range of hills along the eastern side of Highburn Key. At the Northern end of the key these hills terminate in a conical peak which is about a hundred feet high. The sides of this hill are not only very steep but but are composed of crumbling lime rock, and were it not for the fact that itisc overed everywhere with a dense growth of trees it would be almost impossible to climb it.

This hill is the home of typical S. grayi and here they are very abundant, living by preference on the stems of a kind of wild fig tree which has white bark.

Form No. 1 occurs at the base of thc hill on the western side, while No.2 occurs on the flats near the northern bay, and the singular No. 3 in the vicinity of the ruins of the house on the top of the hill, midway of the eastern arm of the key. The range of S. grayi may be thus given, as from the ruin, of which I speak, northward along the esatren border of the range of hills about a mile to the northern hill, when it extends all over this hill, thence westward across the plain, passing through the forms No. 1 and 2, to the bluffs on the western borders of the key, thence northward about one half the length of the key, to a deep gorge that makes in from the sea, just north of a point of cliffs. Then, excepting along the very edge of the cliffs, the species is replaced by the small sub-species described.

38 STROPHIA GRAYI GIGANTEA Novo.

Gigantic Strophia.

Fig. 44, A, front view.

DESCRIPTION.

Sp. Ch. Size, very large. Shell, heavy. Striations, present. Whirls, eleven. Examined fifty specimens.

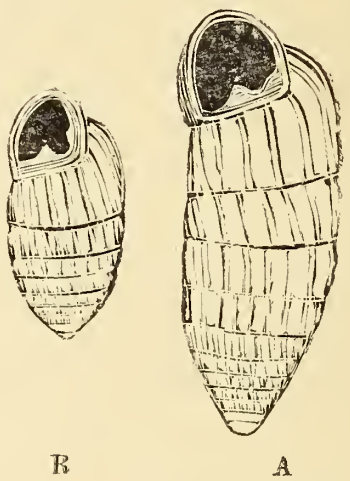
Form of shell, cylindrical, the first, second and third whirls are about equal in diameter, the fourth is but little smaller, then the shell slopes gradually to a rather acute point, forming an angle of sixty-five degrees. The striations are few, twenty-three to the first whirl. Are not prominent, quite regular, and arranged in lines; they are slightly inclined from right to left, are rather narrow, hence the interspaces between them are wider than they; they are not furrowed, but are smoothly rounded, but not polished.

Aperture, quite small, inclined to be rounded, and is slightly contracted at the entrance. The lower tooth is quite prominent, .04 high, and is about twice as long as high. It is set back about once its length, but is rather depressed below the level of the frontal bar, and is about central in position. The upper tooth is slightly developed, and is about on a level with the middle of the central tooth.

Margin produced forward about as far as the diameter of the shell, but not beyond it; it is thin, being about as thick as the shell behind it, and the edge is smooth and rounded, but is not produced into a thin edge. The frontal bar is well developed, and completely interrupts the striations.

Color of shell, externally, dull white throughout; internally, pale brown, fading into white on the tooth and margin.

FIG. 44.



B A

A, Strophia grayi gigantea. B, Strophia grayi pumilia.

DIMENSIONS.

Size of type, 1.56 by .55. Largest specimen, 1.67 by .60; smallest, 1.40 by .55. Greatest diameter, .70; smallest, .55. Longest specimen, 1.67; shortest, 1.40.

OBSERVATIONS.

Individual variation in this sub-species is considerable, the inclination being toward an even larger form, with coarser and fewer striations. This large form has twelve whirls and the largest specimen, of which the dimensions are given above, has thirteen whirls, thus exceeding the maximum number of any species hitherto examined by me. Aside from these variations there is a distinct form, as follows.

No. 1. Similar to the type in general form and size, but with narrower striations, which are less prominent, and the color is dull, ashy brown, with the striations creamy white, also darker brown internally.

HABITS AND DISTRIBUTION.

The Gigantic Strophia occurs in the thickets which grow along the hillside to the southward of the ruin of which I have spoken as being on the eastern hill, midway of the key. They are very solitary in habit, each usually living apart from its fellows.

The dark form I found in a little valley on the hillside near the landing-place, which is near the head of the southern bay, under the thick shade of some dense foliage.

39 STROPHIA GRAYI PUMILIA Novo.

Short Strophia.

FIG. 44. B, front view of type.

DESCRIPTION.

SP. CH. Size, rather small. Shell, heavy. Striations, present. Whirls, nine. Examined, fifty specimens.

Form of shell, a short cylinder, with the first three whirls about equal in diameter, the fourth is somewhat smaller, then the shell slopes quickly to an abrupt point, forming an angle of seventy-five degrees. The striations are few, eighteen to the first whirl, not prominent, rather regular, but not arranged in lines; they are nearly straight, especially on the two upper whirls, but on the remainder of the shell are slightly inclined from right to left; they are narrow, being only about half as wide as the interspaces between them, are rounded, and although not furrowed, are not particularly smooth.

Aperture, rather small, inclined to be rounded and open. Lower tooth rather prominent, about .03 high, and about twice as long as high, is a little elevated is set back about once its length from the frontal bar, and is about central in position. Upper tooth present, but very small and elevated above the top of the lower.

Margin, not produced forward quite as far as the diameter of the shell, and although placed a little to the right of the center of the shell is not inclined to the right. The edge is rounded, and considerabl thicker than the shell behind it, but is not rolled backward. The frontal bar is developed well enough to completely interrupt the striations, but projects very slightly beyond them.

Color, dull white throughout, externally; internally, pale brown becoming white on the teeth and margin.

DIMENSIONS.

Size of type, .90 by .42. Largest specimen, 1.08 by .45; smallest, .95 by .37. Greatest diameter, .50; smallest .37. Longest specimen, 1.03; shortest, .85.

OBSERVATIONS.

Variation lies between a margin as thin as in typical S. grayi, sometimes protruded, frontal bar and all, and a thickened margin, with a very low frontal bar.

As will be seen this sub-species, as well as S. g. gigantea, possesses some of the characters of both S. grayi and S. ritchiei but as the specimens which show intergrading links are between these two forms and S. grayi, this fact, taken in connection with the circumstances under which they are found, points clearly to the conclusion that they are derived directly from S. grayi.

HABITS AND DISTRIBUTION.

I found about fifty of this singular little Strophia clinging to the stems of two or three small trees that grew just south of the deep gorge, that limits the southward range of S. grayi, as given under that species. The space in which they occurrred could not have exceeded a hundred square feet. No specimens of S. grayi, were, however, found very near them, and this little colony had become isolated, and from some cause had advanced far toward forming a species.

40 STROPHIA EBURNIA Novo.

Ivory Strophia.

Fig. 45, A, front view, B, side view of type.

DESCRIPTION.

Sp. Ch. Size rather small. Shell, quite thick. Striations, present. Whirls, ten. Examined, 100 specimens.

Form of shell, an elongated cylinder with the first three whirls about equal in diameter, the fourth is but little smaller, then the shell slopes to a rather acute point, forming an angle of sixty-five degrees.

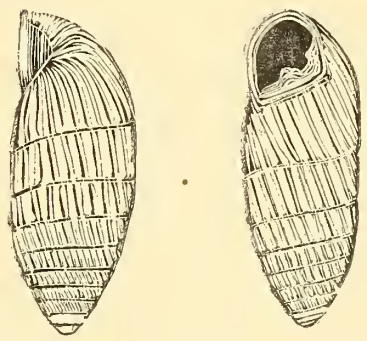
The striations are quite nnmerous, twenty-five to the first whirl, are not prominent, quite regular, but not arranged in lines. All are considerably inclined from right to left, they are smoothly rounded

and polished, and a little more than one half as wide as the interspaces between them.

Aperture, rather small, but quite open, and not at all contracted at the entrance. Lower tooth, rather prominent, a little elevated, about .03 high, and about three times as long as high. There is a slight tubercle on the left side between it and the upper tooth. The upper tooth is also well developed, and extends further forward than is usual, while the space between it and the tubercle is inclined to be filled in.

Margin, not produced as far forward as the diameter of the shell, and is placed more nearly central in the shell than is usual, and does not incline at all to the right, it is a little thickened, with the edges beveled and produced backward into a blunt edge. The frontal bar is not well developed, but completely interrupts the striations.

FIG. 45.



B A

Strophia eburnia, A, front view, B, side view, of type.

Color of shell, externally, ivory white, with a faint bluish tinge, as is plainly noticeable in the sutures between the whirls; within it is rather pale brown, which color extends over the teeth very nearly to the edge of the margin before fading into creamy white.

DIMENSIONS.

Size of type, 1.15 by .45. Largest specimen, 1.32 by .47; smallest, 1.00 by .45. Greatest diameter, .48; smallest, .42. Longest specimen, 1.47; shortest, 1.03.

OBSERVATIONS.

Individual variation in this well-marked and peculiar species is in two ways, as follows:

One is towards a larger, more pointed form and another towards one which is shorter. The tubercle on the left side of the central tooth is peculiar and marks a tendency which in some specimens becomes very prominent and forms a decided double tooth. With this double tooth, which appears in about one half the specimens examined,

which were unfavorable to the Strophias, so they gradually died.

The remains were scattered quite regularly over the entire surface of the key, but, judging from specimens examined, they remained alive longest in the southern portion of the islet near the site of the Indian well, of which I have spoken.

42 STROPHIA NEGLECTA Novo.

Neglected Strophia.

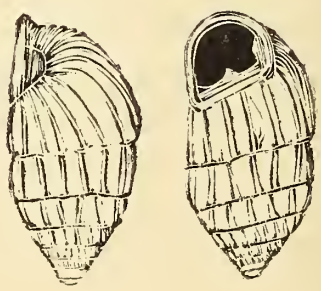
FIG. 47, A, front view, B, side view of type.

DESCRIPTION.

SP. CH. Size medium. Shell, heavy. Striations, present. Whirls, nine.

Form of shell, rather oval, the first and second whirls being about equal in diameter. Then the shell slopes to a quite acute point, forming an angle of sixty-two degrees. The striations are few, fifteen to the first whirl, are very irregular, and not arranged in lines; those on the first whirl are many of them straight, but some are inclined from right to left; on the remaining whirls all are inclined, but some more than others, hence the striations present a peculiarly broken appearance; they are partly rounded, and although not furrowed, are broken and roughened in many places. They are narrow, not one half as wide as the interspaces between them.

FIG. 47.



B A

Strophia neglecta. A, front view, B, side view, of type.

Aperture, not large, well arched above, and very slightly contracted at the entrance. Lower tooth, not very prominent, about .02 high, and about twice as long as high, width about equaling height; its position is about central, and slightly elevated. Upper tooth, placed quite high, considerably above the top of the lower tooth, is about one half as large as the lower.

Margin not produced forward quite as far as the diameter of the shell, is placed a little to the right of the center of the shell, and is very slightly inclined to the right; it is about twice as thick as the

shell behind it, with the edge beveled and produced into a sharpened edge, which is, however, not rolled backward. The frontal bar is not well developed, not protruding beyond the striations, but completely interrupts them.

Color of shell, externally, ashy throughout, striations and all; internally, pale brown, becoming paler on teeth and margin.

DIMENSIONS.

Size of type, .92 by .45. Largest specimen, 1.05 by .50; smallest, .77 by .40. Greatest diameter, .50; smallest, .40. Longest specimen, 1.05; shortest, .77.

OBSERVATIONS.

Individual variation is toward a larger shell, with a thicker margin and with more striations, but not in any marked degree, on one hand, and toward a smaller form with a thinner margin and fewer striations.

This singular Strophia may be at once distinguished from any other by the peculiar ashy color, which in many specimens has a decidedly bluish cast, but more particularly by the wide apart, irregular striations, which, being inclined in different degrees, give the shell a singularly rough appearance, in-so-much so, that I know of no shell of this genus that approaches it in these particulars.

This species often occurs in collections labeleld as S. glans, but the glans of Kuster, as figured by him, as cited, under that head, further on in this monograph, is a white shell, with rather numerous, quite regular, striations, and does not at all resemble S. neglecta, excepting possibly in being of an oval form.

HABITS AND DISTRIBUTION.

In January, 1884, I found the Neglected Strophia on the borders of a deserted plantation on New Providence about a mile west of Fort Charlotte. Here they were abundant, clinging to the bushes, and were also on the fence that divided the plantation from the road that runs from Nassau to the westward. All gathered in this locality at that time were typical.

Nine years later, in March, 1893, I visited the spot and found the plantation recultivated. The bushes were uprooted, and the entire locality changed into sisal hemp fields. On these plants, a

long in being covered; thus it was that I found so many dead shells on the surface.

Why the species did not retreat to the rocks on either side can be explained by supposing that the shrubbery there was not of the proper kind for their sustenance, for it is a fact that the species of Strophia live by preference upon particular trees, shrubs or herbiage, as I have shown in several cases, and seen in several others.

One other fact remains to be mentioned before closing this brief history of the Ivory Strophia, and that is that I discovered a single specimen of what I must at present consider as this species (although it is too stout, lacks the upper tooth, and differs somewhat otherwise to be quite typical) on a key that lies about a half mile north of U Key, which I have called Pimlico Key, on account of the abundance of the Pimlico, or Audobon's Shearwater which inhabit it. I did not find a single specimen, besides this, of any form of Strophia, either living or dead, on the key, therefore conclude that this must have been drifted there by ocean currents.

41 STROPHIA ELONGATA Novo.

Long Strophia.

FIG. 46, A, front view, B, side view of type.

DESCRIPTION.

SP. CH. Size, rather large. Shell, thick and heavy. Striations, present. Whirls, eleven. Examined twenty-five specimens.

Form of shell, a long cylinder, with the first three whirls about equal in diameter, the fourth is but little smaller, then the shell slopes to an acute point, forming an angle of sixty-nine degrees. The striations are numerous, thirty-three to the first whirl, are not prominent, are narrow, and although numerous, no wider than the interspaces between them; they are inclined to be angular rather than rounded, are regular, but not arranged in lines, and are very slightly inclined from right to left.

Aperture, quite small, somewhat elongated, but rather open. Lower tooth very large, prominent and double, having an elevation to the left, and also a small tubercle to the right. This tooth is about .11 high, and about as wide and long as high. The upper tooth is small and about on a level with the top of the lower tooth.

Margin, produced forward nearly as far as the diameter of the

shell, is rather central in position in the shell, and is slightly inclined to the right, but not beyond the diameter of the shell. It is thickened, about .05, and is beveled. The frontal bar is well developed, and is considerably thickened, completely interrupting the striations.

Color of shell, as far as can be made out from dead specimens, was white, externally, brownish within.

DIMENSIONS.

Size of type, 1.33 by .50. Largest specimen, 1.45 by .52; smallest, 1.27 by .45. Greatest diameter, .55; smallest, .45. Longest specimen, 1.45; shortest, 1.27.

OBSERVATIONS.

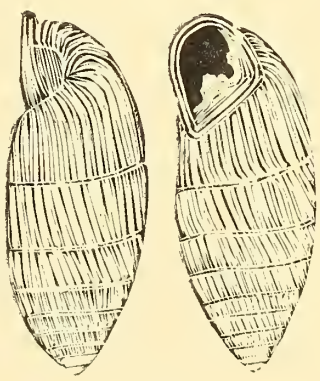
Individual variation is toward a form that is more elongated, but still with eleven whirls, otherwise there is but little variation from the type. The large double central tooth of this species shows the relationship of this shell with S. eburnia, and, as it inhabits a key only about a mile distant, is beyond doubt the ancestor of that species.

HABITS AND DISTRIBUTION.

The Long Strophia occurred on a little key that lies about a mile north of U Key, at Allen's Harbor. I say occurred, for as far as we could ascertain by the most careful search, no living specimen is now to be found on the key, nor were were there any shells seen that appeared to have been very recently alive, but some show great age.

In an article, earlier in this volume, I have spoken of this key as having been the resort of the Lucayan Indians, and the conch shells of which I have spoken as having been opened by them, do not appear to be older than many of the specimens of Strophia elongata which lie scattered near them, hence we may conclude that this Strophia was living on the key when it was inhabited by the Indians Possibly then the key was partly cleared of shrubbery, and after the departure of the Indians the thick growth, which now covers it, sprung up causing changes,

FIG. 46.



B A

Strophia elongata. A, front B side view.

we find a decided tendency to fill in the space between the upper and lower teeth.

When the tooth is not double it is elongated to a great extent, sometimes more than three times its length. With this elongated central tooth we also find that the upper tooth is extended forward often to the edge of the margin; a character, which, excepting in the extinct species, S. elongata, next described, I have observed in no other Strophia. Thus it will be seen that a species of Strophia living, as will be seen under the head of Habits it does live, in an exposed situation, on a small, wind-swept key, has in order to maintain a better control of its shell, not only, in some cases, assumed the elongated central tooth, which we find in species which live in similar situations, but which in other individuals accomplished the same purpose by assuming a double central tooth and has further closed the aperture by filling in the space between the central and the upper teeth. Again, in other individuals, for the same purpose the upper tooth is projected forward.

Another variation is in color. I have a single specimen of ivory white, without and within. This specimen has the double tooth quite well indicated, with the space between it and the upper tooth partly filled. One or two specimens show faint indications of fleckings between the striations.

HABITS AND DISTRIBUTION.

On page 13, of the present volume, I have given a diagram of the singular islet which I have named U Key. I mentioned in the article which accompanied this diagram that the eastern and western sides, or arms, of the U, were hilly, and that on the southern portion of the key the land was low and sandy. This sandy tract was covered with a spare growth of palms and had been the home of the interesting Ivory Strophia.

I say "had been" for from the western side of the sandy land, which I have indicated by a number of †, to the eastern border of it, I did not find a living specimen of a Strophia, although the ground was strewn with hundreds of dead specimens in all stages of decay, with now and then a perfect individual, but all were bleached perfectly white by the sun. On nearing the little hill on the eastern border of the sand, I began to find fresher specimens, but not until I came to the rocks of the hill itself, did I discover a living shell. Then I

collected twelve, which were all clinging to some low bushes, but although I spent several hours in two days and examined every branch and twig of every bush in the vicinity, and searched all other portions of the key, I could not discover another living specimen of Strophia eburnia.

I was therefore thoroughly satisfied that I had chanced upon a second species, S. albea being the other, which was on the verge of extinction. The large number of dead shells, some of which showed marks of having been lying on the sand for many years, proved most clearly that individuals of this species were abundant once, and that the last stronghold of the species was the bushes on the borders of the little hill. The species had fought bravely for an existence against some foe which it could not conquer, and had gradually succumbed, leaving the battle-field strewn with its dead, while I was just in time to gather the handful of survivors, among which, I ought to mention, was a single young specimen.

Now what was the foe that proved so fatal to this species? From a long and careful consideration of the subject, aided by many facts which I cannot now mention, I unhesitatingly answer, the sand, on which the dead shells now lie strewn. Once, in all probability, this tract was naked rock, covered with palms or bushes. Then the Ivory Strophia found a congenial home there, for during wet weather it would pass from bush to bush, or from palm to palm, and thus joining its fellows, on neighboring bushes, by mutual cross-fertilization increase the race. Changing ocean currents formed a sand beach outside the rocks and this sand was carried by the winds over the narrow neck of land, in time completetly covering the rocks. Now, even in wet weather, the Strophias cannot well travel on sand, thus, when each bush or palm was surrounded, the mollusks on it became as much isolated as would be a ship-wrecked mariner when cast upon a lonely island, miles from other land. Then two things occurred, gradually the wind, especially during hurricanes, threw the Strophias off their feeding grounds on to the sands, from which they could not escape, hence they perished. The decay of the race was probably hastened by the fact that when a few were left, they became, in time, too closely related to perfect fertilization, thus after a time few or no young appeared. Hence I found only a single young specimen among a dozen adults.

How long it took for the sand to cover the neck of land is impossible to say, but, after the beach was formed, it was probably not

species of agava, I found Strophias in considerable numbers, but few among them were typical S. neglecta, most of them being intergrades between the Neglected Strophia and the Agava Strophia, or were the S. neglecta agava itself. Incredible as it may seem, after the most careful examination of specimens and the ground in the vicinity of the old type locality, I am forced to the conclusion that, as a species with a distinct locality, Strophia neglecta no longer exists. In nine years these shells, placed under different environment by the clearing of the fields, and planting of sisal hemp, have produced a form which I must consider, at least, as being sub-specific. To be sure, a few typical specimens do exist, but they are scattering, and I will venture to predict that in ten more years, it will be exceedingly difficult, if not impossible, to find a typical Strophia neglecta anywhere alive. In searching for typical S. neglecta on my last visit, I was very much surprised that I could not find it, seeing clearly that the specimens I was collecting were far from typical, but I was even more astonished when I came to compare the newly-gathered shells with those that had been lying in my cabinet for nine years, to note the difference. This difference I have tried to express both in the figures of the parent stock and in those of the sub-species, and in the description of them, but one must see the two forms together to thoroughly comprehend how marked these differences are.

I wish to be distinctly understood to say that I have never found a single example of what I consider as Strophia neglecta a hundred yards from the type locality, nor one of the sub-species elsewhere than in the sisal fields to the west of Nassau, or along the road that borders them, as given under the head of the sub-species.

43 STROPHIA NEGLECTA AGAVA Novo.

Agava Strophia.

Fig. 48, A, front, B, side view, of type.

DESCRIPTION.

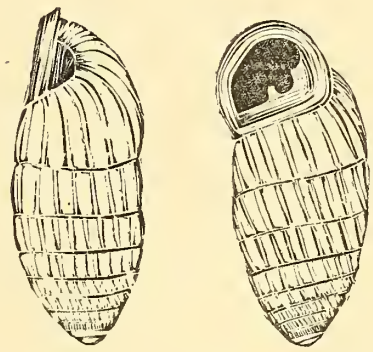
Sp. Ch. Size, rather above medium. Shell, thick and heavy. Whirls, ten. Striations, present. Examined 500 specimens.

Form of shell, a pointed cylinder, with the first two whirls about equal in diameter, then the shell slopes gradually to a rather acute point, forming an angle of sixty-three degrees. Striations, rather numerous, twenty-four to the first whirl, they are rather

narrow, not as wide as the interspaces, quite irregular, smoothly rounded, and inclined to be polished. They are slightly inclined from right to left, and well arranged in lines.

Aperture, rather large, quite open, and not contracted at the entrance. Lower tooth, quite prominent, about .05 high, and not quite twice as long as high, slightly elevated, and set back about once its length from the frontal bar. Upper tooth well developed, about half as large as the lower and is placed a little above the top of the lower.

Fig. 48.



B A

Strophia neglecta agava. A, front, B, side view of type.

Margin, produced forward about as far as the diameter of the shell, is placed quite nearly in the middle of the shell, and is only slightly inclined to the right. It is about twice as thick as the shell, is beautifully beveled, and projected backward into a blunt edge. The frontal bar is slightly developed, and the striations are indicated within it.

Color of shell, externally, yellowish ash, striations and all; internally, brownish, becoming paler on the teeth and margin.

DIMENSIONS.

Size of type, 1.21 by .47. Largest specimen, 1.35 by .50; smallest, .93 by .42. Greatest diameter, .50; smallest, .42. Longest specimen, 1.35; shortest, .93.

OBSERVATIONS.

Individual variation in this sub-species is toward a smaller form, with coarser, more widely-apart striations, thus passing through a small percentage of specimens into typical S. neglecta, and on the other hand, into a larger, heavier form, with striations about as in the type.

This well-marked sub-species differs from typical neglecta in the larger size, thicker margin, and more numerous striations. From all other Strophias it may be known by the acute apex and singular color.

HABITS AND DISTRIBUTION.

In March, 1893, I found the Agava Strophia common throughout the sisal fields to the westward of Nassau as far as the fields extend, and I traced it for about eight miles westward and about a mile back from the coast. The form becomes more typical as it recedes from the type location of S. neglecta, and we found some very fine, large specimens about a mile south of this point.

This shell, which has beyond all doubt, been developed into what is nearly a well-established species through the clearing of the fields, is frequently found clinging to the huge leaves of the sisal plants, but it is also found on herbage and shrubbery which grows in the fields.

44 STROPHIA CARLOTTA Novo.

Ft. Charlotte Strophia.

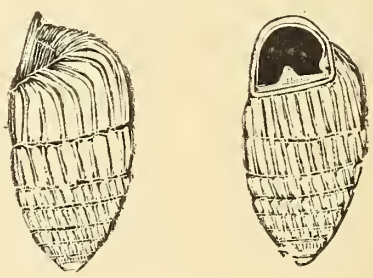
Fig. 49, A, front, B, side view, of type.

DESCRIPTION.

Sp. Ch. Size, small. Shell, rather thin. Striations, present. Whirls, nine. Examined 1,000 specimens.

Form of shell, oval, with the first whirl the largest, the second is but little smaller, then the shell slopes gradually to a rather blunt point, forming an angle of seventy degrees. The striations are quite numerous, twenty-four on the first whirl, they are a little narrower than the interspaces between them, are beautifully rounded being about one half as high as wide and considerably polished. They are straight and slightly inclined from right to left.

Fig. 49.



B A

Strophia carlotta. A, front B, side view, of type.

Aperture, placed near the center of the shell, is not large, arched, short, about as high as wide and not much contracted at the entrance. Lower tooth, not prominent, .03 high, narrow, not as wide at high and about twice as long as high, is set back about once its length from the frontal bar, and is not elevated. The upper is about one half as

large, is placed low, not once its width from the floor of the cavity.

Margin, not produced forward quite as far as the diameter of the shell, is a little thicker than the shell behind it, is slightly beveled into a blunt edge, but this is not produced backward. The frontal bar is not very well developed, although it completely crosses the aperture, yet the striations are indicated within it.

Color of shell, reddish brown, externally, with the striations paler. Pale brown internally, becoming paler on the teeth and magrin.

DIMENSIONS.

Size of type, .85 by .40. Largest specimen, 1.00 by .43; smallest, .72 by .35. Longest specimen, 1.00; shortest, .72. Greatest diameter, .43; smallest, .35.

OBSERVATIONS.

Individual variation is toward a form with a thickened margin, that is beveled and grooved, in this respect resembling the margin of a fossil form (S. agassizi) recently described by Dall (Bulletin Mus. Comp. Zool. Vol. XXV, 1894, p. 122) as coming from the aeolian limestone, of the top of the quarry, about a mile east of Ft. Charlotte. While S. agassizi may be the remote ancestor of this species, it is probable that it has passed through several species since then. S agassizi has no striations, but I have found a large fossil Strophia scattered through the aeolian limestone of the surface of New Providence, in the neighborhood of Nassau, which is more probably the immediate ancestor of S. carlotta. Individual variation is also toward producing a form with coarser, more widely-apart, striations. Individuals of this kind were doubtless the origin of S. neglecta, for S. neglecta, although such a strongly marked species, has some characters in common with S. carlotta, such as general form, wide, low aperture, nine whirls, and the peculiar form of the striations, which in S. carlotta are, as nearly as possible, half pillars, recalling at once the beautifully-polished striations of S. albea from Spruce Key. Those striations appear of the same general form in neglecta and through it in S. n. agava, but they are broken and somewhat roughened in S. neglecta. They have, however, in a measure, regained their original form in S. n. agava. Besides these individual variations, we find two well-marked forms.

No. 1. A dwarf form, the smallest given in Dimensions. Whirls, eight, and striations, eighteen to the first whirl, otherwise the same as in the type.

No. 2 is larger, with nine whirls, thicker margin, and with a heavier shell. This form in some respects resembles S. n. agava and was it not for the fact that it differs in color, and has a lower, wider aperture, resembling the type S. carlotta, and that S. n. agava intergrades directly with S. neglecta, it might be supposed to be the direct origin of the Agava Strophia.

The Fort Charlotte Strophia may be known by the peculiar oval form, less wide aperture, and reddish color. This species resembles S. glans more than it does any other shell in form, but in S. glans the shell is white, and the aperture rather higher than wide and the margin thicker.

HABITS AND DISTRIBUTION.

Strophia carlotta occurs in the immediate vicinity of Fort Charlotte, New Providence. The type locality is at the foot of the hill, on which the fort stands, on the north side. Here they were found on low bushes and herbage. Further up the hill toward the fort, almost under the shadow of the walls of the small old Spanish fort, which stands a little to the eastward of the large structure, occurred the small form No. 1.

To the westward of the type locality, nearer the bushes and among them, we collected the larger from No. 2.

I think the origin of the dwarf form can be traced directly to the dryness of the soil on the hill top. At the time of my visit in March, 1893, the foliage of the shrubbery was so parched with heat and lack of moisture that it crumbled in the hand. We have seen another instance where a dwarf form has been produced by a dry environment in Strophia nana, on Little Cayman, but the extreme pigmy size of this species was also probably due, partly, to feeding upon a peculiar plant. See Vol. I of these contributions, page 27.

45 STROPHIA GLANS Kuester.

Acorn Strophia.

Fig. 50, A, front view, B, side view, of type form.

Pupa glans Kuester in Chemn. ed. II, Pupa, page 74, plate II, figs. 1 and 2.

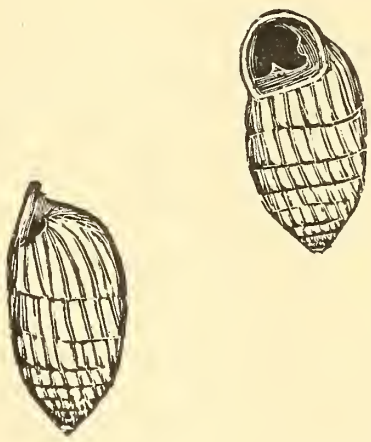
DESCRIPTION.

Sp. Ch. Size, rather below medium. Shell, not heavy. Striations, present. Whirls, ten, Examined 1,000 specimens.

Form of shell, a pointed oval, with the first and second whirls the largest, then the shell slopes to a rather acute point, forming an angle of sixty-five degrees. The striations are rather numerous, twenty-one to the first whirl, are not prominent, but are regular, narrow, about as wide as the interspaces and a little flattened, but smoothly rounded and polished. They are slightly inclined from right to left, but are not arranged in lines.

Aperture, small, arched, about as wide as high, open, and not contracted at the entrance. Lower tooth, rather prominent, .05 high, about as wide as high, and about twice as long as high. It is placed quite near the frontal bar, not quite once its length, is not elevated, and is about central in position. The upper tooth is but slightly developed, being a mere tubercle.

FIG. 50.



B A

Strophia glans Kuster. A, front, B, side view.

Margin, not produced forward as far as the diameter of the shell, and placed rather to the right of the center, and is not inclined to the right. It is thin, a little thicker than the shell behind it, and although it is produced into a blunt edge, this is not rolled backward. The frontal bar is not well developed, being thinner than margin, and it completely interrupts the striations.

Color of shell, externally, dull white, shiny on the striations; within, dull brown, rather dark, fading into white on the margin, but reaching the frontal bar but the central tooth is white, in striking contrast with its dark surroundings.

DIMENSIONS.

Typical size, .92, by .45. Largest specimen, 1.00 by .50; smallest, .80 by .37. Greatest diameter, 1.00. Longest specimen, 1.15; shortest, .80.

OBSERVATIONS.

Individual variation is considerable, and is in the direction of producing a form with a thickened margin, which is sometimes

rounded, sometimes beveled without being grooved, and sometimes beveled with a groove. There is also a tendency to produce a flecked form and one which is grayish in color which is inclined to be larger, with a thickened margin, and through this into the typical sub-species, S. glans grisea, next described. With all this individual variation, which are not pronounced enough to describe as distinct forms, we have three distinct forms, that are inclined to appear in locations of their own.

No. 1 is decidedly more cylindrical, the first, second and third whirls being about equal in diameter, the striations are more numerous, twenty-five to the first whirl, and they are even less prominent than in the type. While the color externally is slightly inclined to be grayish, externally; internally, it is paler, with the space in front of the tooth, and around it, white. There are about two per cent. of this form.

No. 2. Form and color that of the type, excepting that the whirls are nine, with the size small, .80 by .37. There are about four per cent. of this form.

No. 3, a large, heavy shell with, a thickened margin (about .10), that is beveled and decidedly grooved. The form is a pointed cylinder. The striations are narrower and are inclined to be angular.

As far as I can judge from an account, which, like most of the older descriptions of shells of this genus, is much too brief to clearly define any species, and from a good figure, the shell that I have described above is most undoubtedly the species which Kuster had in hand when he described his Pupa glans. Thus we can with considerable certainty establish the status of another of the old species of Strophia.

The locality from which Kuster's type came is unknown, and the following is his original description in Latin, with a translation:

"Testa rimata, ovata acutiuscula, roseo-alba, fortiter costata, costis confertis oblis; anfractibus, 10, convexusculi, angustis, ultimos fusco-subfusciatus; apertuta semiovata, intus nitida, palada flava, peristomata recurvo, incrassato, parie aperturali umplicatus."

Shell fissured (umbilicated), rather acutely oval, rosy-white, striations prominent, striations close together and oblique; whirls, ten; somewhat rounded, narrow, the last partly fusciated with fuscous. Aperture, semi-oval, polished within, and pale yellow. Peristome (margin) recurved, not thickened. Teeth of aperture, one.

The size is given as about twenty-three millimeters by ten wide and the habitat of the shell described was unknown to Kuster. Pfeiffer, however, in Monographia Heliceorum, Vol. VI, page 291, gives the locality as "New Providence, insularum Bahamensium." In Vol. I of the same work, Page 216, he substantially gives a copy of Kuster's description, but in Vol. VI, says nothing further about the shell than to give the habitat. Now from these facts we may reasonably conclude that Pfeiffer never saw Kuster's types, but fitted some shell to his description. This shell was possibly my S carlotta, but this has nine whirls, not ten, and can scarcely be called "rosy-white," nor does it resemble Kuster's figures as cited at the beginning of this article.

Now, while in some particulars, the shell, which I have decided to identify as the S. glans of Kuster, does not coincide with either his figure or description it is quite like both, so near in fact that I do not believe we shall ever find any species of the genus that will answer better, hence it seems to me best to fix upon this form and so definitely establish the status of Strophia glans.

HABITS AND DISTRIBUTION.

I found the type form of Strophia glans in some fields which lie directly south of the little settlement of Fresh Creek, but on the opposite side of the creek, in December, 1888, and again in 1893. On both occasions I found all of the forms described, but on my first visit I did not find the intergrades between this species and its sub-specific form given below.

Form No. 1 occurs in the southernmost fields about a mile from the creek, while on the borders of the creek in some rocky fields is form No. 2, while No. 3 is found among the bushes which border the fields. The Acorn Strophia lives on small shrubbery and on herbage, in the fields and about them, and is rather scattering, nowhere appearing in great numbers.

46 STROPHIA GLANS GRISEA Novo.

Gray Acorn Strophia.

Fig. 51, A, front view of type, B, margin of same.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, heavy. Striations present. Whirls, ten. Examined 200 specimens.

Form of shell, cylindrical oval, the first and second whirls being the largest and about equal in diameter, then the shell slopes to a rather acute point, forming an angle of sixty-five degrees. The striations are rather numerous, twenty-five to the first whirl. They are not prominent, narrow, not wider than the interspaces between them, are regular, inclined to be arranged in lines and rounded, but not polished.

Fig. 51.

B A

Strophia glans grisea. A, front view of type. B, margin of same.

Aperture, small, about as wide as high, rather contracted at the entrance. Lower tooth, prominent, oval, about .05 high, as wide as high and not quite as long as high, it is not placed far back, not once its length, and is not elevated. The upper tooth is a mere tubercle and is placed low, not higher than the top of the lower tooth.

Margin, produced about as far forward as the diameter of the shell, is placed a little to the right of the center of the shell and is inclined slightly to the right. It is thick (.12), beveled, and grooved. The frontal bar is not very well developed, is thin, not over .02 thick, but completely interrupts the striations.

Color of shell, externally, grayish ash, striations and all; ashy brown, within, which color extends over the teeth, where it is paler, however, and quite to the edge of the margin.

DIMENSIONS.

Size of type, 1.10 by .45. Largest specimen, 1.15 by .47; smallest, .95 by .40. Greatest diameter, .47; smallest, .40. Longest specimen, 1.15; shortest, .95.

OBSERVATIONS

As far as the specimens which came from the type locality are concerned, this is a very uniform form of shell, there being only a slight individual variation in form and a little in color internally, but the peculiar gray tint of the external surface is very constant and characteristic. Had I never seen shells from any other locality than from the fields north of Fresh Creek, I should have unhesitatingly said that this was as strongly marked a species as I had ever seen, with

strongly marked species, but it occurs in the fields on the south side of the Creek where it completely intergrades, through a small percentage of specimens with typical S. glans; hence I have been forced to consider it a sub-species.

The Gray Acorn Strophia may be known at once by the thick, grooved margin, and peculiar uniform gray color which I have not seen in any other form of Strophia.

HABITS AND DISTRIBUTION.

The first specimen of the Gray Acorn Strophia that I ever saw were brought to me by some Creole boys, but I soon discovered the typical locality, which were some fields north of the creek, about a mile from the settlement, and by the side of the road which leads northward to Calabash Bay. Here they were not common and were clinging to the bushes along the margin of the cultivated fields. South of the creek the few that I found were also clinging to bushes either in the fields or along the borders, but here they were even more rare than in the type locality. These specimens on the south side were undoubtedly transplanted from the north side through the agency of the inhabitants, who pass from one set of fields to the other, carrying with them the plants of the casava on which the Strophias frequently occur.

47 STROPHIA REGULA Novo.

Regular Strophia.

FIG. 52, A, side, B, front view of type.

DESCRIPTION.

SP. CH. Size, large. Shell, not very thick. Striations present. Whirls, twelve. Examined fifty specimens.

Form of shell a pointed cylinder, with the first, second and third whirls about equal in diameter, the fourth is but a little smaller, then the shell slopes to an acute point, forming an angle of sixty-two degrees. The first whirl is comparatively short, being only as long (measured in front) as the next four whirls below it, all together. The second whirl is shorter than the third and fourth, together, then each successive whirl is shorter than the next two below it. The striations are numerous, twenty-nine to the first whirl, they are narrow, about as wide as the interspaces between them, are rather angular, but are

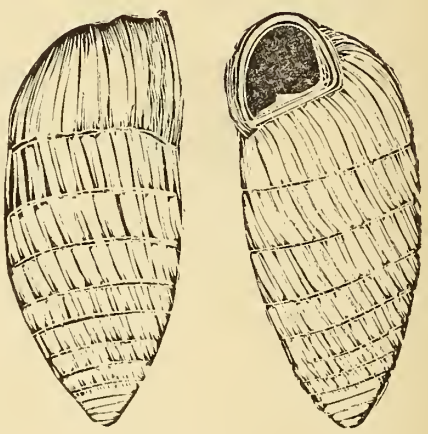
slightly flattened on top, not furrowed, but smooth, are very regular, and of about the same width for their length on each successive whirl, and are arranged in lines with scarcely an interruption on each line, from the first whirl to the apex.

Aperture, rather small, arched and about as high as wide, and is slightly contracted at the entrance.

Margin, produced forward about as far as the diameter of the shell, is slightly inclined to the right, a little beyond the diameter of the shell, is thin, about as thick as the shell behind it, with the edge smoothly rounded. Behind it, the shell is much roughened with lines of growth, which, on the sides project, showing an inclination to form a double margin. The frontal bar is well developed, protruding considerably beyond the striations, and is about as thick as the margin.

Color of shell, dull white throughout, pale brown within, becoming paler on the margin.

FIG. 52.



A B

Regular Strophia. A, side, B, front view of type.

DIMENSIONS.

Size of type, 1.50 by .60. Largest specimen, 1.50 by .63; smallest, 1.15 by .50. Longest specimen, 1.50; shortest, 1.15. Greatest diameter, .62 ; smallest, .50.

OBSERVATIONS.

As all the specimens of this fine shell that I ever saw were occupied by a species of hermit crab, which always smooth away any inequality in the shells of which they take possession, the teeth were always worn nearly or quite away. Judging from the remains of the lower in the type, I should say that it had been large and prominent.

Individual variation is toward a smaller form, 1.15 by .50, with eleven whirls, and also toward a form with more widely-apart and less regular striations, but all preserve the short upper whirl which is so characteristic of this species. In S. glans, S. bimarginator, and

other species found on Andros, as far as I have seen them, excepting one to be described later, the upper whirl is about as long as all the other whirls together. Aside from this peculiarity, S. regula may be at once distinguished by the large size, narrow, equally wide striations, arranged in lines across the rather narrow whirls, which have shallow sutures, that are not notched, thus the whole combination makes up one of the most beautifully regular species of Strophia that I have ever seen, being excelled in this respect only by S. dallii, from Inagua, but, of course, S. dallii belongs to an entirely different sub-genus ; see page 130 of Vol. I of these Contributions.

Since a large portion of the present instalment of my monograph has been put into type, I have received Dr. Dall's paper on the shells collected during the " Cruise of the Steam-yacht ' Wild Duck ' in the Bahamas, January to April, 1893, in charge of Alexander Agassiz," which paper occupies No. 9, of Vol. XXV, Bulletin of the Museum of Comparative Zoology. On pages 121 to 123 of this paper Dr. Dall has named the groups which I suggested were clearly separable, considering them, as being at least sub-generic.

Dr. Dall's names for the sub-generic groups suggested by me are as follows, the characters, however, are from the earlier pages of my Monograph :

1. DIACERION.

LOWER TOOTH GREATLY ELONGATED, CHANNELED; POSITION CENTRAL. S. dalli Mayn. is Dall's type.

2. STROPHIOPS.

LOWER TOOTH ELONGATED, SIMPLE; POSITION CENTRAL. Type given by Dall, Pupa ducamana Fer.

3. MAYNARDIA.

LOWER TOOTH, SHORT, SIMPLE; POSITION CENTRAL. Dall's type is S. neglecta Mayn.

4. CERION.

LOWER TOOTH, SHORT, SIMPLE, POSITION NOT CENTRAL. Dall's type is Turbo uva Linn.

5. EOSTROPHIA.

LOWER AND UPPER TEETH ABSENT. Type, E. anodonta Dall. This last group was defined by Dall in Cf. Trans. Wagner Inst., Vol. III, No. 12, August, 1890.

As an additional sub-generic character for Maynardia I will add that the young of all the Bahama Strophias, with one exception (see S. bimarginata), which I have examined belonging to this sub-genus have a single tooth, there never being even an indication of any other (see fig. 33, page 108, of this volume of Contributions and compare with figs. 1, D, and 5, C, plate II, vol. I.

[Note. In the paper cited above, Dr. Dall shows that the name Strophia Albers. 1850, must be abandoned for this genus, as it has not only been superceded by Cerion Bolton, 1799, but has also been preoccupied in Entomology (Mergen, Syst. Beschr. III, 147, 1832). To avoid confusion, however, I shall continue the name of Strophia until the close of this Monograph.]

HABITS AND DISTRIBUTION.

The only specimens that I ever saw of this beautiful Regular Strophia, were, as remarked, occupied by the young of a species of Hermit crab, Diobeta diogines, and appeared to be quite a favorite shell with them. The crabs with their adopted shells were found on both sides of Fresh Creek near the settlement. Some of the shells appeared to be quite old and much stained, but some were comparatively fresh ; for example, the type, which I have figured, aside from the wearing away of the teeth and a small hole broken near the margin on the left side, is perfect, and the color of the internal parts is well preserved. But we could not discover any living specimens anywhere, although we searched with great care. It is probable, therefore, that Strophia regula is also an extinct species ; but still it is possible, that the shell is to be found at some distance up the creek, the specimens found having been brought down by the out-going tide, and stranded on the shore where they could be found by the crabs. But I made a careful search of both banks of the creek for at least two miles from the settlement, and found no trace of a Strophia, of any kind, after leaving the immediate vicinity of the settlement. Then again, I do not think it probable that a species of Strophia would occur far from the coast, for I have never found one far from the sea.

48 STROPHIA BIMARGINATA Novo.

Double-Margined Strophia.

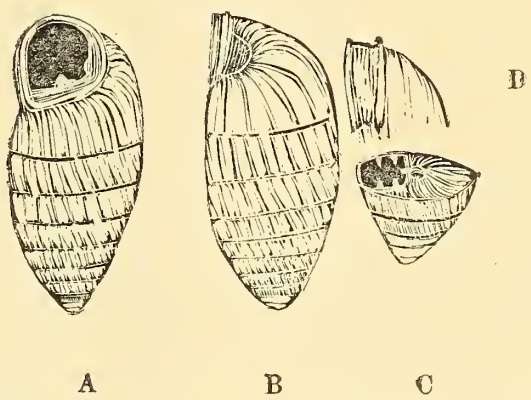
Fig. 53, A, front view, B, side view, of type ; C, young (enlarged), D, double margin of another specimen.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, of medium thickness. Striations, present. Whirls, ten. Examined 2,000 specimens.

Form of shell, a pointed cylinder, the first, second and third whirls being about equal in diameter, then the shell slopes gradually to a rather blunt point, forming an angle of seventy degrees. The striations are not very numerous, twenty-three to the first whirl; they are rather regular, narrow, not quite as wide as the interspaces, are inclined to be triangular, but are slightly rounded, smooth, but somewhat furrowed, are only partly arranged in lines and a little inclined from right to left.

Fig. 53.



Strophia bimarginata. A, front view; B, side view of type. C, young, enlarged, D, margin of another adult specimen.

Aperture, quite small, inclined to be rounded, open at the entrance, but contracted within. Lower tooth, prominent, double, with the second smaller and placed on the left of the larger; the larger tooth is about .05 high, about as wide as high and not twice as long as high, the smaller one beside it is about half as large and is closely connected with the larger; both are somewhat elevated, are about central in position, and are placed back a little less than once the length of the larger from the central bar. The upper tooth is a mere tubercle, is elevated a little above the top of the lower tooth and the space between the two is inclined to be filled up.

Margin produced forward about as far as the diameter of the shell, it is thin, about as thick as the shell behind it, and is smoothly rounded, without being produced into any edge. Immediately behind this first margin is a second margin with the edge roughened and between this double margin the shell shows lines of growth, having, in fact, formed the inner margin first, then, after adding more to the shell, formed a new margin. The frontal bar is well developed and completely interrupts the striations.

Color of shell, externally, pure white, rather lustrous, internally,

pale brown, a little darker in shade well within the shell, and becoming white on the margin.

DIMENSIONS.

Size of type, 1.07, by .45. Largest specimen, 1.20 by .55; smallest, .80 by .35. Greatest diameter, .55; smallest, .35. Longest specimen, 1.35; shortest, .80.

OBSERVATIONS.

Individual variation is considerable and extends in several directions. The form is sometimes shorter and wider proportionally, much as in S. glans, and the margin is thinner and less inclined to be double, but is never beveled as it is, and differs from S. glans, in maintaining the small rounded aperture. Some specimens are also more cylindrical and smaller in diameter. The double tooth occurs only in perfectly adult specimens and is not always present then. This would also appear to be a character which seems strongest in individuals which are placed in exposed situations, and thus now is rather of a secondary specific character, but as the species becomes more fixed, the double tooth will become more constant; it is present, however, is about seventy-five per cent. of the specimens obtained on Green Key, the locality of the type, and in about 50 per cent., or a little less, of the specimens from Little Galden Key.

The double margin of this species is a singular character, and one which I have not seen in any other species of Strophia. It is present in a more or less marked degree, in nearly all adult shells, but sometimes the doubling is represented by lines of growth on a simple grooved and beveled edge; possibly, even in these cases, there will be another margin formed. In the example given in Fig. 52, D, there has been two distinct margins formed, both beveled, grooved, and marked with lines of growth, a significant fact and one to which I will refer again.

In this connection it is worthy of remark that I have a single specimen of S. glans in which two distinct margins have been formed, a considerable distance apart, but I shall figure this specimen and refer to it later.

The doubling of the margin and of the teeth in this species appears to have sometimes caused reversion to some long past ancestral type, which was the common ancestor of all the sub-genera of the genus, for in this species we find that several teeth appear in

young shells, at least I have one specimen, a very young shell, with five whirls only, in which five teeth appear, almost exactly as seen in the young specimen of S. pannosa and of S. festiva figured on Plate II, Vol. 1 of these Contributions. Compare these figures with Fig. 52, D, of the present volume, where I give a figure, twice enlarged, of a young S. bimarginata, taken on Green Key, in April, 1893. I have also another specimen, from the same place, that is older, which has, besides the tooth in the usual place on the column, another on the upper portion of the walls of the aperture and two indications on the larva. Other older specimens have simply the one tooth as seen in all other members of the sub-genus Maynardia, but I should not be at all surprised to find this character appearing, at least occasionally, in very young specimens of other members of this sub-genus. As also showing a tendency to revert to ancestral types, I have two adult shells in which there is no indication of any teeth whatever. (See remarks regarding the form of sub-genus Eostrophia on page 163.)

I have remarked that the type form of this species came from Green Key, off Andros, but this species also occurs on Little Galden Key, Middle Bight, Andros. But the shells from this latter-named place here have caused me no little perplexity. They appear different from those on Green Key, as they lie in mass in the boxes, side by side, and I considered them different when I collected them, but when I try to get at some exact character which will separate the shells from the two islands I utterly fail to find any which will answer even to represent a form. All I can say, is, that, on the average, or taken in mass, the shells from Little Galden Key are larger, coarser and darker in color, internally, and with an inclination to a creamy tint, externally.

There are, however, two forms, one of which is also found on Little Galden Key, and a well-marked sub-species, developed on Green Key.

No. 1 is a large, coarse form, with an inclination to assume a bevelled margin and single tooth, with a darker interior. This form also appears on Little Galden Key, but here is even larger with a decidedly creamy color externally. On both keys the shell is found in the thicket away from the beach.

No. 2 is a small form, the smallest dimensions given, with a thin margin, and with a tendency toward a single tooth, although this is sometimes doubled. The color is dicidedly bluish, and I have two or three specimens which are considerably flecked. This form occurs among the low grass of the rocks of Green Key.

HABITS AND DISTRIBUTION.

All along the eastern coast of Andros stretches a barren reef which varies in distance from the island from one to five miles. This reef is continuous excepting where it is broken at the entrance of the bights or creeks that make into the land. Here and there, along this reef which divides the lagoon between it and the land from the deep water of the Tongue of Ocean rose little islets varying in size from the merest points of rocks, just awash by the waves at high water, to keys ten acres in extent which rose sometimes thirty or forty feet above high water. One of those large islands is called Green Key. [Of keys of this name I know three; one near New Providence, one here on the coast of Andros and one (a large key) about thirty-five or forty miles south of it, but on the opposite or eastern side of the Tongue of Ocean.]

This key contains about five acres of land. It is rather low, backed on the eastern or seaward side, by rough jagged rocks which are somewhat elevated, and, on the western side, along the lagoon, by lower, smoother rocks. Directly on the water the rocks are exposed, but back of them the key is covered with a dense growth of bushes. It was along the lagoon border that we found Strophia bimarginata.

They were clinging in clusters of from five to twenty-five or thirty individuals to the grass and herbage along the margin of the bushes, but were seldom found on the bushes themselves. but deeper in among the bushes we found the larger form No. 1. while form No. 2 was found on the lower herbage nearer the water.

On Little Galden Key, Middle Bight, which I have described on page 29 of these Contributions, we found the shells in a similar situation, but never on either key on the eastern or seaward side. I also found a form, corresponding to No. 1, in the woods at Little Galden Key.

49 STROPHIA BIMARGINATA CERA, Novo.

Waxy Strophia.

Fig. 54. A, front view, B, margin, of type.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thin and light. Striations, present. Whirls, ten. Examined nine specimens.

Form of shell, a pointed cylinder, with the first three whirls

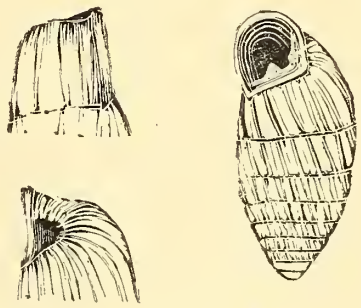
equal in diameter, then the shell slopes to a moderately acute point, forming an angle of sixty-two degrees. The striations are not numerous, twenty to the first whirl, they are narrower than the interspaces between them, regular, and somewhat broken, but smoothed on top, not arranged in lines, and are slightly inclined from right to left. The spaces between them are narrow, with one or two distinct lines or ridges of growth.

Aperture, rather small, arched, but open, and inclined to be rounded. Lower tooth, prominent, inclined to be double, about .03 high, wider than high, and about twice as long as wide, is slightly elevated, and placed in a central position and back not quite once its length from the frontal bar. The upper tooth is represented by a mere tubercle.

Margin, not produced forward quite as far as the diameter of the shell, is about twice as thick as the shell behind it and is smoothly rounded, with the sides slightly furrowed with lines of growth. The frontal bar is quite well developed and protrudes a little beyond the striations.

Color of shell, externally and internally, is a beautiful waxy white, without tinting or marking of any kind.

FIG. 54.



A B

Strophia bimarginata cera. A, front, B margin, of type.

DIMENSIONS.

Size of type, 1.00 by .40. Largest specimen, 1.07 by .47 smallest, .97 by .45. Greatest diameter, .47; smallest, .40. Longest specimen, 1.07; shortest, .97.

OBSERVATIONS.

Individual variation, on one hand, is toward the parent stock, S. marginata, the margin being wide, but never double, and the interior slightly tinted with very pale brown, and on the other hand, toward specimens with a thinner margin, showing no lines of growth and a single small tooth as beautifully white in color as in the type.

There is a singular resemblance between this sub-species and

Strophia curtissii nivia in color and somewhat in form, but S. b. cera is larger, with a smaller aperture, more widely apart striations, with lines of growth between. From all other Strophias this sub-species may be distinguished by the peculiar waxy color and thin shell, which is nearly as translucent as white wax, insomuch so that the animal may be seen through it.

HABITS AND DISTRIBUTION.

The few specimens of this fine Strophia which I obtained were taken from trees or bushes on Green Key.

50 STROPHIA PILSBRYI Novo.

Pilsbry's Strophia.

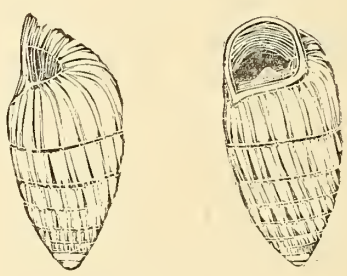
Fig. 55. A, front, B, side view of type.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, rather thin and light. Striations, present. Whirls, ten. Examined 125.

Form of shell, an elongated pointed oval, the first whirl being the largest, the second, third and fourth being successively a little smaller, then the shell slopes a little more rapidly to an acute point, forming an angle of sixty-three degrees, The first whirl is short, equalling in width the next four. The striations are not numerous, twenty-two to the first whirl, are a little narrower than the interspaces between them, inclined to be angular, slightly ridged, with ridges of growth between them are not very regular, not at all arranged in lines and not in the least inclined, being straight from the upper whirl to the apex.

Fig. 55.



B A

Strophia pilsbryi. A, front, B, side view, of type.

Aperture, quite small, open, not at all inclined to the right. Lower tooth, not prominent, triangular, being as wide as high, and a little longer than wide. It is very slightly elevated, and set back from the frontal bar not quite its length.

Margin, single, not produced forward quite as far as the diameter of the shell, it is thin, a little thicker than the shell behind it, is smoothly rounded, and produced backward into a blunt edge, While the frontal bar is quite well developed, it does not project much beyond the striations.

Color of shell, externally, pale ashy blue, becoming horn color on the apex, and waxy white on the margin, which extends backward past the teeth when the shell becomes quite abruptly brown, with almost a sharp line of demarkation.

DIMENSIONS.

Size of type, 1.07 by .45. Largest specimen, 1.09 by .45; smallest, .87 by .37. Longest specimen, 1.09; shortest, .87. Greatest diameter, .45 ; smallest, .37.

OBSERVATIONS.

Individual variation is not great. As might be expected, there is some marks of reversion toward the type form, which, as I shall clearly show, must have been S. bimarginata, and this reversion takes the form which we should most expect, that of the double tooth, but this is never as marked as in typical S. bimarginata, and out of the one hundred and twenty-five examined I have found twenty only, and in more than one half of these the central tooth had the slightest indication only of the doubling.

This double tooth is never accompanied by the double margin, and the only indication of the feature so prominent in S. bimarginata is a slight furrowing of a thickened and beveled margin in some specimens.

There is a decided inclination to produce a form with fewer striations, some, in fact, being nearly smooth on the upper whirl.

There is one decided form, and that is one in which although the form has not changed, the color has become reddish ash throughout, striations and all. This color appears in intermediate specimens on the apex, thence gradually spreads, through other specimens, over the entire shell. Some adults are slightly flecked. This is the form through which the sub-species next described, S, p. evolva, was derived.

I have named this interesting species of Strophia for Mr. A. H. Pilsbry, the accomplished curator of conchology at the Academy of Natural Sciences, Philadelphia.

HABITS AND DISTRIBUTION.

I have said that Little Galden Key lies at the entrance of Middle Bight, and about a half mile directly west of it is a long, narrow islet, called Goat Key, thus it is situated well within the Bight; but owing to the trend of the southern shore of the Bight it is quite near this portion of the main island. The key is only about one eighth of a mile long, and nowhere over fifty yards wide. This little spot of land, however, is of great interest from a conchological point of view, for it not only contains two distinct species of Strophia and one sub-species, but these forms are in themselves remarkably interesting, as will be seen.

So important is this Key, and the Strophias which live upon it, that I have given a little chart of it (See Fig. 56) which, although

FIG. 56.

Diagram of Goat Key, Middle Bight, Andros. P, eastern portion of Key, E, western; †, section inhabited by Strophia pilsbryi. ⁂, section inhabited by S. p. evolva. ‡, spot inhabited by S. restricta.

accurate enough, perhaps, for the purpose for which it is intended, must be regarded simply as a diagram.

As will be seen by consulting the figure, also, the key is nearly divided into two parts, these two parts being connected, in fact, by a narrow sand bar over which the water flows during very high tides. The easternmost portion is surrounded by a sand beach, but the central portion is higher and is covered by a spare growth of bushes. This portion of the key is the home of Pilsbry's Strophia, but it was not common there at the time of our visit in April, 1893. The form No. 1, which I have indicated, occurred toward the western end of this portion. I have noted the range of the Strophias by a number of †s.

51 STROPHIA PILSBRYI EVOLVA Novo.

Pilsbry's Mottled Strophia.

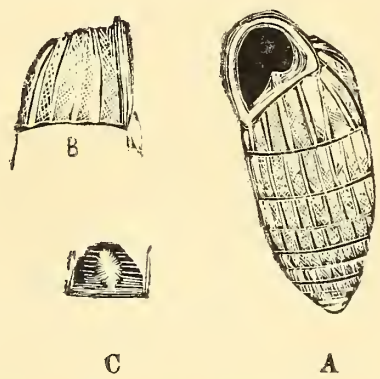
FIG. 57, A, front view, B, margin, of type.

DESCRIPTION.

SP. CH. Size, rather small. Shell, rather heavy. Striations, present. Whirls, ten. Examined seventy specimens.

Form of shell, a pointed cylinder, with the first and second whirls equal in diameter, the third is but little smaller, then the shell slopes to a point, forming an angle of sixty two degrees. First whirl, short, equal to the next four smaller. The striations are not numerous, twenty-two to the first whirl, are rather regular, but somewhat broken, narrow, not as wide as the interspaces between them, smoothly rounded, polished, but some of them are slightly furrowed, and the interspaces are slightly ridged with lines of growth.

FIG. 57.



Strophia pilsbryi evolva. A, front view, B, side view of type. C, Lowor tooth as seen from above.

Aperture, rather small, arched, about as high as wide, and is slightly wider within than at the entrance. Lower tooth, not very prominent, .03 high, wider than high, and a little more than twice as long as high, it is not elevated, but the floor of the entrance slopes away from it, and the tooth is projected forward nearly to the frontal bar. Its position is about central. Upper tooth is a mere tubercle.

Margin produced forward about as far as the diameter of the shell, and is considerably inclined toward the right, quite beyond the diameter of the shell, it is thick, about .07, beveled, grooved, and very faintly marked with lines of growth. The frontal bar is quite well developed, protruding slightly beyond the striations, and is very obliquely inclined to the right.

Color of shell, externally, ashy yellow, mottled and blotched with ashy brown, the mottlings assuming a transverse direction, somewhat as in Strophia mumia; internally, dark brown, which color extends quite to the margin, leaving the tooth, however, pale, and the margin nearly white.

DIMENSIONS.

Size of type, 1.12, by .43. Largest specimen, 1.17 by .43; smallest, .90 by .40. Greatest diameter, .43; smallest, .40. Longest specimen, 1.17; shortest, .85.

OBSERVATIONS.

Individual variation is great, and the most noticeable is toward producing a white form, which is clearly a reversion toward typical S. pilsbryi, in fact, this form grades directly into the parent stock.

Another variation, which may be considered as progressive, is toward producing a shorter, thicker form, with nine whirls and with numerous striations, thirty to the first whirl, they are regular, and not wider than the interspaces, and the first whirl is as long as the first five, while the aperture is inclined to be rounded, and more in the centre of the shell than in the type. The color is also dark, nearly uniform ashy brown, but with central tooth as in the type. I notice this form particularly as I believe that it will be found somewhere, at some time, as an established species.

Directly opposite this is a larger form, more cylindrical, with the first three whirls equal in diameter, and with the transverse mottlings more pronounced. This form seems to mark the direction in which the sub-species is trending to establish a full-ranked species. Occasionally a specimen will show a double margin.

As will be seen, the characters which mark this fine sub-species are, first, and most important, the elongated central tooth projected well forward, toward the frontal bar, a remarkable character and one which I have never seen so prominent in any other species of this genus; second, the form of the margin, with its oblique bar; thirdly, the peculiar mottlings, recalling those of S. mumia. Besides, we have the usual characters which almost always accompany the evolution of a dark, mottled form of shell from a white form, namely, the thickening of the shell and contraction of the margin. All of these characters in combination, together with the fact that this form has a location of its own, go to make up good and sufficient specific characters and I would so consider them, but there is yet too great a number of specimens which must be considered as intermediate.

HABITS AND DISTRIBUTION.

This strongly marked sub-species occurs on the bushes of the western and larger portion of the Goat Key, (E, in the chart, fig. 55,)

but along its southern border; I have marked its range with a series of *s. The form is not abundant in numbers and rather scattering.

52 STROPHIA RESTRICTA Novo.

Restricted Strophia.

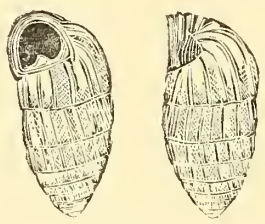
Fig. 58. A, front view, B, side view, of type.

DESCRIPTION.

Sp. Ch. Size, very small. Shell, rather heavy and thick. Striations, present. Whirls, nine. Examined seventy-five specimens.

Form of shell, an elongated oval, the first and second whirls being about equal in diameter, the third is a little smaller, then the shell slopes to a rather acute point, forming an angle of fifty-eight degrees. The striations are quite numerous, nineteen to the first whirl, are about as wide as the interspaces between them, are beautifully rounded and polished, very regular and arranged in lines.

Fig. 58,



A B

Strophia restricta. A, front, B, side view.

Aperture, very small, not quite as wide as one half of the shell, arched, and about as high as wide. Lower tooth, not prominent, about .03 high, as wide as high, and about twice as long as high. It is not elevated, and is set back nearly once its length from the frontal bar. Upper tooth, absent.

Margin produced forward about as far as the diameter of the shell, it is nearly straight and not inclined to the right. It is about as thick as the shell behind it, beveled below on either side, marked with fine lines of growth, but doubled above with lines of growth between the two divisions. The frontal bar is well developed, and protrudes beyond the striations, and is but little inclined.

Color of shell, externally, ashy white, mottled, but not transversely, with reddish brown. Internally, brown, rather dark in shade, extending quite to the margin, but this and the tooth are paler.

DIMENSIONS.

Size of type, .75 by .32. Largest specimen, .92 by .37; smallest, .62. by .32. Greatest diameter, .37; smallest, .32. Longest specimen, .92; shortest, .62.

OBSERVATIONS.

Variation is toward a slightly larger form, but with about the same proportion, but with a beveled margin with lines of growth only, also toward a more pointed form with the first whirl the largest. There is also the following distinct form:

No. 1. White in color, and with a tendency to assume a less number of striations. The margin is beveled and grooved, but in some individuals is doubled.

This singular little Strophia may be distinguished from S. thorndikei, which it resembles somewhat, by the heavier shell, thicker margin, smaller aperture and different color. I know of no other Strophia which it resembles.

HABITS AND DISTRIBUTION.

About midway on the southern side of the western portion of Goat Key is a little bay, and on the western border of it is a small mangrove swamp. A sand beach entirely surrounds this portion of the key, but along the little bay, especially to the eastward of the mangrove swamp, the land being low (for the mangrove swamp evidently represents an old lagoon) the sand has encroached upon the land considerably. This sandy tract, however, in the immediate neighborhood, is covered with bushes, or small trees. It was on one of these little trees and on a few shrubs very near it that I found the colony of the singular little Strophia restricta.

On Goat Key one can learn a lesson in the evolution of species of Strophia which will prove of great value to him. Here on this little spot of land, at most not over three acres, we find three distinct forms of this genus of shells; and be it remembered that this island is distant from Little Galden Key only about a half mile, yet, as seen, it is impossible to assign even characters which will define a form to the Strophias which live on Green and Little Galden Keys, and these islands are about fifteen miles apart! Facts like these have already caused me to remark that I feel that it is far too early in my studies of this genus to even speculate on the origin of many of the species, and more especially on the origin of all the groups, and their connection with one another.

One thing is clear, however, that the Strophias inhabiting Goat Key were derived directly from the S. bimarginata of Little Galden Key. First, S. pilsbryi, through this the dark, flecked S. p. evolva,

and this sub-species gave rise, most strangely, to the little dwarf, S. restricta. The most sceptical regarding the value of color as a specific character has only to visit this key and note the transition of S. pilsbryi into its sub-specific form, with its accompanying correlative characters, while the little S. restricta exhibits clearly how closely one species may live to another and yet be distinct. The sand from which grew the tree and bushes on which I found S. restricta isolated this form as completely, if not more so, than if miles of ocean rolled between them.

I have said under the Habits of Strophia nana (Vol. I Contributions, page 28) that this Strophia had the most limited distribution of any animal with which I was acquainted, but in this respect it must yield the palm to S. restricta, for this species was confined to a single tree and the bushes that came in direct contact with it, in fact, all of the specimens which I collected I gathered without moving a single step.

53 STROPHIA EXIMEA Novo.

Choice Strophia.

Fig. 59. A, front, B, side view of type.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, not very thick. Striations, present, but very fine. Whirls, ten. Examined 1,000.

[Note. This species and the next following belong to a peculiar group of Strophias, which may, with perfect propriety, be placed in a separate sub-genus which may be characterized as follows:

6. MULTOSTROPHIA.

Central tooth, slight, not thicker than high, striations, numerous, exceedingly fine and polished. Type, Strophia eximea Mayn. Locality, Bahamas.]

Form of shell, cylindrical, with the first three whirls equal in diameter, then the shell slopes gradually to a blunt point, forming an angle of sixty-five degrees. The striations are very numerous, fifty to the first whirl, they are rounded, regular, being half cylinders, and they are very slightly inclined from right to left.

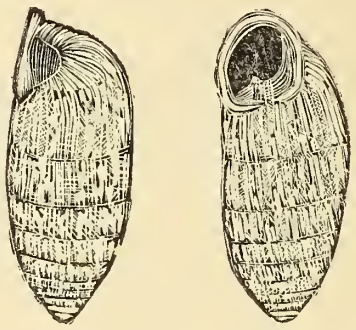
Aperture, large and open. Lower tooth, small, .03 high, thinner than high, but about three times as long as high, is set very far

back, nearly twice its length from the frontal bar. A ridge extends from tooth to the third whirl. Upper tooth absent.

Margin produced forward about as far as the diameter of the shell, is placed very nearly in the centre of the shell and is not inclined to the right, is about twice as thick as the shell behind it, is smoothly rounded on the edge and rolled over into a rather sharp edge. The frontal bar is not well-developed and does not cross the shell, being broken in the middle, hence does not completely interrupt the striations, which appear within it.

Color of shell, externally, white, beautifully marked with longitudinal and rather continuous streaks of dark reddish brown. Internally, far within the shell, pale brown becoming white on the entire margin, tooth, and space around it, with a slight creamy tinge.

FIG. 59.



B A

Strophia eximea. A, front, B, side view of type.

DIMENSIONS.

Size of type, 1.12 by .45. Largest specimen, 1.12 by .47; smallest, .75 by .37. Greatest diameter, .47; smallest, .37. Longest specimen, 1.30; shortest, .97.

OBSERVATIONS.

There is considerable individual variation, one is toward a cylindrical form with even more numerous striations, sixty to the first whirl, with a contracted aperture, and eleven whirls. A color variation is a paler form with rather narrow markings, which are also paler. There is a tendency to produce a form with an entire frontal bar.

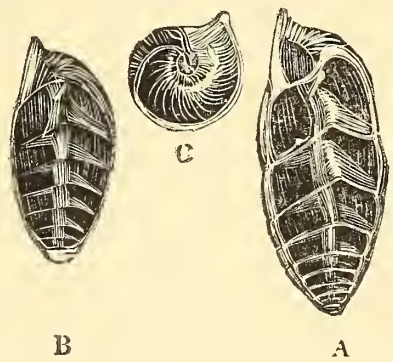
There is also the following well-defined form:

No. 1. Size, very small. Whirls, nine. Color, form and striations as in the typical form.

This is not the Pupa martensiana of Weinland for in that species the teeth are given as two and the margin as being thick. S. eximea may be distinguished from all other shells of this sub-genus by the large size, in the type form, and always by the dark, wide longitudinal markings.

There is one remarkable character in this species which is found in all the forms and one which is, as far as I have examined, peculiar to this Strophia, although I shall expect to find it occurring in others. That is a swollen ridge which, beginning back of the central tooth, winds about the column about once its width from it, thus leaving a furrow between it and the column, extends, gradually lessening in size, and it is lost in the third whirl. This ridge was once the resting place of the central tooth, and in one place, in one of the specimens examined, a tubercle still remains on at the partition in the lower portion of the second whirl, See Fig. 61, A, being a section of a specimen of S. eximea, and the tubercle may be seen in the second whirl. This elevated ridge is no thicker than the other portion of the floor of the whirls, consequently has a corresponding hollow beneath. Nothing of the kind appears in the apparently closely-allied species S. agrestina, where the floor of the whirls is perfectly simple. See Fig. 61, B, where I have given a section of S. agrestina. C, is a cross-section of the top whirl of S. eximea, showing the central tooth and beginning of the ridge.

FIG. 61.



B A

A, section of S. eximea. C, cross section of same. B, Section of S. agrestina.

HABITS AND DISTRIBUTION.

All that I can give under this heading is the fact, that the specimens from which the above description was made were procured by Mr. Curtiss, in Nassau, from a creole who brought them from Cat Island.

The species is, however, not uncommon in collections, often labelled as Pupa or Strophia martensi or martensiana.

54 STROPHIA AGRESTINA Novo.

Grass Strophia.

Fig. 60. A, front view, B, side view, of type. C, margin, Form No. 3.

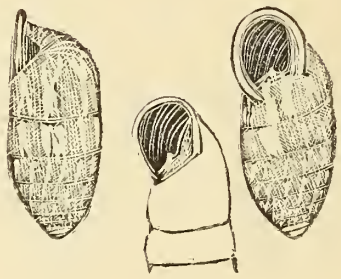
DESCRIPTION.

SP. CH. Size, small. Shell, very thin and fragile. Striations

numerous and small, but perfect. Whirls, nine. Examined 1,000 specimens.

Form of shell, quite cylindrical, but with the first whirl a little smaller than the second and third, which are equal in diameter, then the shell slopes to a blunt point, forming an angle of sixty-five degrees. Sections between the whirls very shallow. Whirls not bulging. The striations are numerous, thirty-seven to the first whirl, they are small, less than half cylinders, but rounded and perfect for their entire length, and slightly inclined from right to left, and are a little wider than the interspaces between them, while the entire shell is polished.

FIG. 60.



A C B

Strophia agristina. A, front, B, side view of type. C. margin, Form No. 3.

Aperture, very small and open. elongated and arched, but scarcely higher than wide. Lower tooth, about .02 high, about as narrow as high, and three times as long as high and is set back a little more than its length from the frontal bar. Upper tooth absent.

Margin not produced forward quite as far as the diameter of the shell, it is thin, not as thick as the shell behind it, is smoothly rounded in front, and rolled backward into a blunt, but well-developed, edge. The frontal bar is only slightly indicated, but completely interrupts the striations.

Color of shell, creamy white, externally, marked with wide, rather continuous, lines of reddish brown. Pale brown, within, fading into creamy white on the margin, leaving the tooth white, in contrast with the dark surrounding.

DIMENSIONS.

Size of type, .87 by .35. Largest specimen, 1.10 by .40; smallest, .55 by .32. Greatest diameter, .42; smallest, .32. Longest specimen, 1.10; shortest, .55.

OBSERVATIONS.

The young of this species have, as a single tooth, the upper; this is singular, as mature shells, with rare exceptions, have no trace of this tooth.

Individual variation is considerable; in one direction it is toward a form, with a larger, more rounded orifice; shells like this are inclined to have the upper whirl larger than the others, also all the whirls bulge slightly. On the other hand there is a shorter form, with straight whirls. A color variation is towards a paler form with the white predominating. As the reverse of this, I have a single specimen of a beautiful chestnut brown throughout, slightly streaked with creamy. This specimen has assumed correlative characters and is thicker with a more contracted orifice, and it is cylindrical in form, the first four whirls being equal in character. Besides these variations, which may be considered as purely individual, we find the following three well-defined forms:

No. 1. A dwarf form with eight whirls, size, .55 by .30, otherwise as in the type. This form is largely represented, at least twenty per cent. of the whole number, and I have reasons for believing that the tendency of the entire species is in this direction.

No. 2, a large form, 1.10 by .32, rather cylindrical with the first four whirls equal in diameter, with the shell thicker, and the orifice large. This form is quite largely represented, but as most of the specimens are dead shells, many of which I did not collect, I cannot give the exact percentages. The tendency is for this form to pass out of existence, or in other words, the species has passed through this form and is becoming smaller.

No. 3 is a singular form, with the first whirl decidedly smaller, and the aperture nearly central, disproportionately elongated, considerably higher than wide and with the first whirl quite small (See fig. 60, c). This form is so pronounced that it is quite likely to become specific in time.

This is not the Pupa martensiana of Wienland (See remarks on this head under Observations in S. eximea) yet it is so labelled in many collections which I have examined. This shell is very thin and fragile, so thin, in fact, that the striations can be plainly seen through it, when looking in at the aperture. I have never seen any other shell which resembles the Strophia agrestina, even belonging to this sub-genus, in this respect. The large form of S. agrestina and small specimens of S. eximea are alike in size, but differ so utterly, as described, as to be at once distinguishable, but the best character, aside from the thinness of the shell, in the Grass Strophia, is the absence of the frontal bar, this being quite well developed on either side in S. eximea.

Before closing this article I want to add a few words in regard to

the shell named Pupa martensi Weind, inasmuch as this name and that of P. martensiana are often confused, and I have even seen specimens of Strophia agrestina labelled as S. martensi.

S. martensi is a very peculiar shell, differing from most species of the striated Strophias in having a regular constriction to the striations, near the sutures, thus somewhat isolating a series of rounded knobs above each suture (there may, however, be more than one species so characterized), resembling, somewhat, a form of the little S. nana, figured on Plate II, fig. 11, B, Vol. 1, of these Contributions (See also description, page 28).

HABITS AND DISTRIBUTION.

The Grass Strophia occurs on the south side of New Providence, about opposite of the city of Nassau but distant from it some six miles. They live in pine woods, among which grow scattering palms, about a half mile from the shore, and occur under stones, fallen palm leaves, shrubs, etc., or are found clinging in clusters among the tufts of grass of which there is a scanty growth in this locality. I cannot give the exact range of this species, but I have traced it for several hundred yards along the two roads which go to the south side beach. I have found them on two occasions, one in February, 1884, and then in March, 1893. On both occasions they were quite abundant.

SUBTERRANEAN WATER WAYS IN THE BAHAMA ISLANDS.

That the Bahama Islands are of comparatively recent origin, geologically considered, will be doubted by no one who has given the matter any attention. That their existence is also due largely to the coral polyp is quite obvious, for when we come to examine the keys which make up this group of islands we find that all of them not only show marks of having once been sunken reefs of coral, but many of them are unmistakeably elevated atolls. I say elevated, for on many of the beaches, or sea borders, we find every evidence of two upheavals, possibly at not very wide intervals apart. That is, we have the present level of the higher hills and land, and on many of the keys, an old beach, or high water mark, exhibited by blocks of coral

CONTRIBUTIONS TO SCIENCE.

BY

CHARLES J. MAYNARD.

Volume Three. March, 1896.

MONOGRAPH OF THE GENUS STROPHIA.

(Continued from Vol. II, page 182,)

The first portion of the present instalment of this monograph is based upon specimens belonging to the Museum of Comparative Zoology, Cambridge, Mass., where I have been permitted to examine them through the kindness of Prof. Alexander Agassiz, with a view of determining the species; I have returned the types figured to the Museum, but have retained a set of co-types in my own collection. I wish also to thank Dr. Walter Faxon for valuable assistance in many ways in preparing this paper.

55. STROPHIA CHRYSALIS Ferussac.

Chrysalis Strophia.

Plate I, fig. 1, front view, fig. 2, side view of typical specimen.

Ferussac, Hist. Nat. Moll. 1820-1851, Vol. II, page 205. Plate 153, figs. 1 and 2 (not fig. 7, nor figs. 7 and 8 plate 156) .

DESCRIPTION.

Sp. Ch. Size, rather large. Shell, moderately thick and heavy. Striations, present. Whirls, 11. Examined 11 specimens.

Form of shell, a long pointed cylinder, with the first, second and third whirls equal in diameter, then the shell slopes to a semi-obtuse point which forms an angle of forty-three degrees. The striations are not numerous, there being fifteen only to the first whirl, not very prominent, rather irregular, are slightly bowed in the middle of the whirls toward the right, and they are also slightly inclined from right

to left, are narrow, and the interspaces are thus about twice as wide as the prominences. The striations are not furrowed, but are smoothly rounded and polished. The whirls are not bulging and the suture is shallow.

Aperture, large and widely open measuring considerably less within than at the entrance. The lower tooth is very small, about .07 long and is about one half as high as long, its position is about central, but it is set back about twice its length from the frontal bar. The upper tooth is about the same height as the lower, but extends backward around the column.

The margin is not produced forward beyond the diameter of the shell, but is considerably inclined to the right, quite beyond the side, is not thickened (measuring .04 only) but is reflexed outward at least .10, with the edge rolled over and smoothly rounded. The frontal bar is rather indistinct, is well inclined to the right, as the striations appear within it as distinct ridges which continue to appear as far down as they can be seen from the entrance.

Color of shell externally, yellowish white, quite prominently marked with a rather pale yellowish brown which is inclined to form longitudinal patches between the striations. These patches are quite frequently encroached upon by the white along their sides, hence their edges have an undulating or serrated appearance. In some cases the patches are broken quite across by the encroaching white, then the brown appears as a series of thick horizontal lines one above the other. Internally brown, paler than the external markings. This color pales into yellowish white on the tooth and margin.

DIMENSIONS.

Size of typical specimen, 1.35 by .45. Largest specimen, 1.37 by 47; smallest, 1.25 by .41. Longest specimen 1.35; shortest, 1.25. Greatest diameter, .47 ; smallest, .41.

OBSERVATIONS.

The tendency among the specimens examined is to produce on one hand a rather more slender form than the type with the angle of the apex more acute, and on the other, a proportionally shorter, stouter form, measuring, about 1.20 long; rather more highly ornamented with brown markings.

This beautiful species can be readily distinguished by the large size, always over 1.25 long, open mouth with the flanging margin, the prominent striations within, which even appear on the upper wall, and the singular, broken, pale brown markings, which recall those of Strophia mumia.

I found these shells in the Museum collection bearing the simple label "Havanna Cuba". Beyond all doubt, this is the principal species which Ferussac had in hand when he described his Pupa chrysalis in the work cited at the head of this article, as his description clearly indicates, while his excellent figure, although the markings are a little darker in color, coincides almost exactly with the specimen which I have considered typical and figured on plate I. Owing to the broad interpretation of what constituted specific characters which prevailed in his time, Ferussac included two quite different shells in his plates as this species, namely fig. 7 on plate 153, and 7–8 on plate 156, but what these are, I have not yet determined. Thus the localities given by Ferussac, other than Cuba (Guadaloupe and Martinique) are probably those of the other species figured. The size of Ferussac's type is given by him as 35 mill. long by 13 mill. in diameter. Below I have given his diagnosis in the original Latin accompanied by a translation.

"P. testa elongata, turrita, cylindrica, apice obtusa, longitudinaliter plicata, grisea, lineis fuscis angulatis ornata; apertura ovato-rotunda, intus fulva, marginata, unidentata."

This may be translated as follows. Shell elongated, turreted cylindrical, apex obtuse, longitudinally striated, gray, ornamented with narrow, dark lines, aperture, round ovate, fulvus inside, margined, one-toothed.

56. STROPHIA SCRIPTA. Novo.

Inscribed Strophia.

Plate I fig. 3, front, fig. 4, side view of type.

DESCRIPTION.

Sp. Ch. Size about medium, shell rather thick and heavy. Striations, present. Whirls, 11. Examined 29 specimens.

Form of shell a pointed cylinder, the first whirl being the largest, then each successsive whirl is a little smaller to the fourth, from which the shell tapers more suddenly to a semi-obtuse point, forming an angle of fifty degrees. The striations are moderately numerous, twenty to the first whirl, but they are not very prominent. Are quite regular, but not arranged in lines. They are rather straight being curved slightly to the right at their lower terminations, and are slightly inclined from right to left. They are not furrowed, but rounded and polished, and the interspaces between them are twice their width. The aperture is not especially large, measuring but a little more within than at the entrance. Both teeth are represented by a mere tubercle scarcely to be seen even with the aid of a magnifying glass.

Margin, not produced forward as far as the diameter of the shell. It is very slightly inclined to the right, but not beyond the side of the shell. It is exceedingly thin, measuring rather less than .02, is only slightly flanging, being extended outward about .04, it is not rolled over and the edge is only slightly rounded. The frontal bar is very slightly indicated, consequently the striations pass with very little diminution of size directly into the interior of the shell, and a sectionized specimen shows that they continue quite to the apex.

Color of shell externally bluish white, beautifully marked with rather longitudinal patches of deep purplish brown which often overlie the striations as well as the interspaces between them. These brown marks are encroached upon on either side by alternating lines of white which often penetrates nearly through this brown causing it to appear like pen markings made with brown ink. This semblance is heightened by the fact that the brown lines are not often broken through. Internally the color is rather deep purplish brown, paler on the margin.

DIMENSIONS.

Size of type, 1.30 by .47. Longest specimen 1.30 by .50; smallest, 1.05 by .35; greatest diameter, .50, smallest, .35; longest specimen, 1.30; shortest, 1.05.

OBSERVATIONS.

Variation consists in a tendency to produce a stouter form with the first three whirls equal, and also a form with less fleckings.

Form No. 1. In addition to these varieties which must be considered as simply individual, there is a well established form which consists of about twenty per cent of the whole examined. These are smaller, shorter shells with 10 whirls, size, 1.05 by .35. The form and markings are similar to the type form. This fine species was labled "Pupa chrysalis" in the collection, but differs in several important particulars from that species. It is smaller, with a smaller aperture which has a margin that is scarcely flanging at all, the teeth are much smaller, while the fleckings are much darker and are not as much broken into horizontal lines and the shell is more pointed.

These shells were labled as coming from "Cardenas, Cuba, Andros M. de Cisneros [collector] received Jan. 14, 1878."

STROPHIA SCRIPTA OBLITERATA Novo.

Pale Strophia.

Plate I, fig. 5, front, fig. 6, side view of type.

DESCRIPTION.

Sub Sp. Ch. Size, small, shell, rather thick and heavy, striations present, whirls, 10, examined 102 specimens.

Form of shell, a pointed cylinder with the first whirl the largest, the second, third and fourth are successively a little smaller, then the shell tapers to a rather obtuse point, forming an angle of about sixty-three degrees. The striations are few, fifteen to the first whirl. They are quite prominent, rather irregular, quite straight, but not arranged in lines. They are not furrowed, but are smoothly rounded and polished.

Aperture, rather small, slightly contracted within. Both teeth are represented by a mere tubercle.

Margin produced forward about as far as the diameter of the shell and is scarcely inclined to the right. The margin is only slightly flanging and is not rolled over, while the edge is slightly rounded. The frontal bar is quite well developed, but the striations appear within it as quite prominent ridges which extend into the shell quite to the apex, as shown in a sectionized specimen.

Color of shell, ashy white externally, rather sparingly marked with longitudinal patches of inconspicuous pale reddish brown. These patches are frequently broken into transverse lines by the encroachment of the white. Within, yellowish brown which becomes paler on the margin.

DIMENSIONS.

Size of type 1.08 by .40. Longest specimen, 1.13 by .43. Smallest 1.00 by .30. Greatest diameter .43, smallest, .30. Longest specimen, 1.13, shortest, 1.00.

OBSERVATIONS.

There appear to be a number of quite distinct forms.

No. 1 is without markings, being pure white, and as is usual in similar cases, where a white form has become evolved from a colored one, the shell is thinner, with a consequent less development of frontal bar. The average size is a little smaller, but the form is similar. There are about ten per cent of this form.

No 2. Smaller than the type, proportionately stouter, with nine whirls, otherwise similar. There are about seventy per cent of this form in the collection, but as the form described as typical, approaches

nearest to the true S. scripta, I have considered it as the type of the sub-species.

No. 3. More cylindrical than the type, with the first three whirls about equal in diameter and the shell is more slender, measuring about .30 in diameter. Whirls, 10. There are about seven per cent of this form.

No. 4. A beautiful color form of a rich reddish or purplish brown throughout with delicate horizontal lines of white. This may prove to be a well marked sub-species, but as I have two specimens only give it as a form.

No. 5. White in color, with few or no fleckings and with the upper whirl somewhat larger than the second. There are eight per cent of this form.

This sub-species, which after all may prove not to intergrade with S. scripta, may be readily distinguished from it by the smaller size and from the often nearly obliterated markings. These were also labeled "P. chrysalis" followed by the more valuable application of "Matanzas Cuba, rocks close to the sea." Judging from the maps, Matanzas is distant some twenty miles from Cardenas, the home of the true S. scripta. Although both forms may spread over a large area, and thus intergrade at some point on the coast, this is quite improbable and as intimated above, the two may prove quite distinct.

58 STROPHIA FASTIGATA Novo.

Tapering Strophia.

Plate II fig. 1, front, fig. 2, side view of type.

DESCRIPTION.

Sp. Ch. Size, medium. Shell quite thick. Striations, present. Whirls, 10. Examined 62 specimens.

Form of shell, a pointed cylinder with the first whirl the largest, the next four are each successively a little smaller, then the shell slopes abruptly to a somewhat obtuse point, forming an angle of sixty-two degrees There are nineteen striations on the first whirl, not very prominent, not very regular, and not arranged in lines. They are not furrowed on top, but are smoothly rounded and polished.

Aperture about as high as wide rather large and open, being considerably wider at the entrance than further within. Lower tooth small about .04 long by .02 high. It is about central in position, and is placed far back in the shell at about three times its length from the frontal bar. The upper tooth is about the same height as the lower.

Margin, not produced forward as far as the diameter of the shell, is very slightly inclined to the right and a little beyond the side, but is extended outward about .05 and slightly rolled backward and the edge is rounded. The frontal bar is quite well developed, is somewhat obliquely inclined and almost completely interrupts the striations which are slightly indicated only within.

Color of shell, externally, white without markings; internally, pale yellowish brown, fading into white on the margin.

DIMENSIONS.

Size of type 1.20 by .40. Largest specimen, 1.25 by .42; smallest, 1.10 by .35. Longest; 1.20; shortest, 1.10.

OBSERVATIONS.

Young specimens with the margin fully formed, but in which the frontal bar is not fully developed, do not have the teeth. There is very little individual variation, some shells being a little more obtuse than the type, but there is a form as given below.

Form No. 1 with fewer striations, these being mainly absent on all but the upper three whirls, where they are finer and more numerous, about 28 to the first whirl. There is in many instances in this form a distinct double lower tooth. There is also an inclination in some specimens of the type form to assume a double lower tooth.

This species may be distinguished by the rather large aperture, pointed cylindrical form of the shell, comparatively small size and white, unflecked color.

This species I found in the collection in the same tray with the shells which I have named S. scripta obliterata, therefore it is to be presumed that they came from Matanzas, Cuba, but as all of the shells of S. fastigata are deeply stained with a red earth of which those of S. s. obliterata bear no trace, it is evident that they did not come from the "rocks close to the sea" as did the others, but probably from some neighboring field. They were also labled "Pupa chrysalis. Another lot was labeled "Punte Goade, Matanzas, Pupa infanda," and still another lot "Chorrea, Pupa mumia."

59 STROPHIA EURYSTOMA Novo.

Wide-mouthed Strophia.

Plate II fig. 3, front, fig. 4, side view of type.

DESCRIPTION.

Sp. Ch. Size rather large, shell quite thick and heavy. Striations, present. Whirls, 11. Examined 21 specimens. Form of shell

pointed cylinder, with the first and second whirls the largest, then the third whirl is a little smaller, and from this, the shell slopes gradually to a point, forming an angle of fifty-five degrees. There are sixteen striations to the first whirl; they are not prominent, are rather irregular, not arranged in lines, nor furrowed, but rounded and polished, are narrow, the interspaces being twice as wide as they, and slightly inclined from left to right.

Aperture large and open, about as wide as high, not at all contracted at the entrance. The lower tooth is small, about .07 long, and about half as high as long; it is set well back about twice its length from the frontal bar; it is about central in position. The upper tooth is about the same height but extends backward around the column.

Margin not produced forward beyond the diameter of the shell, but is somewhat inclined to the right beyond the side of shell. It is thin, (about .03) considerably flanging, projecting outward about .10, and somewhat rolled over, but the edge is smooth. The frontal bar is not well developed and the striations appear quite prominently within it, extending backward into the shell.

DIMENSIONS.

Size of typical specimen, 1.35 by .40. Largest specimen, 1.36 by .47; smallest, 1.27 by .35. Greatest diameter, .48; smallest, 35. Longest specimen, 1.38; shortest, 1.25.

OBSERVATIONS.

There is some individual variation in the inclination of the margin; some specimens having this about straight. There is one developed form.

Form No. 1. More slender in form, and rather more acutely pointed, and while the striations are more numerous above, twenty-five to the first whirl, they are nearly or quite absent on the lower whirls. I found two of this form in the museum collection, but I find that out of seven shells received from another source, also labeled Havanna, that all, with a single exception, are of this form. Thus it may be possible that this will prove to be a sub-species, inhabiting a locality apart from the typical form.

This species may be distinguished from all of the other flanging-mouthed Cuban shells, yet mentioned, by the open mouth, large size, and white, unflecked color. For comparison with S. infanda of Shuttleworth, see that species.

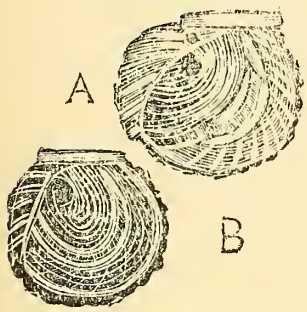
I found these shells bearing the label "Pupa mumia, Havanna Cuba."

The color of the shell of S. eurystoma is yellowish white, externally, with the apex flesh color. Internally, pale brownish or flesh, fading into yellowish white on the teeth and margin. It is worthy of note that shells of the typical form, show stainings of a red ochraceous earth, while those which I have mentioned as form No. 1, are either stained with a brown earth or are without staining, hence it is reasonable to suppose the forms do not occur together. Should this prove true, form No. 1 must take subspecific rank, in which case it may be called Strophia eurystoma ignota.

SUBGENUS 7. TRIDENTISTROPHIA.

LOWER TOOTH CENTRAL, ELONGATED, BEING AT LEAST THREE TIMES AS LONG AS HIGH. BEHIND THIS ARE TWO OTHER TEETH WHICH EXTEND BACK INTO THE SHELL, BUT NO FURTHER THAN ONE-HALF THE LENGTH OF THE FIRST WHIRL. Type, Strophia striatella Ferussac, Habitat, Cuba.

This singular system of teeth recalls the channeled tooth of Diacerion, but differs in not extending as far back into the shell, and in having three distinct teeth, the outer of which is shorter than the inner, and often not being longer than the middle or front tooth. See Fig. 1, A, where I have given a cut of the teeth of Tridentistrophia (S. striatella) and compare with ib B, where I have given a figure of the channeled tooth of Diacerion. Other characters of Tridentistrophia are, striations numerous (30 or 40 to the first whirl); margin, thick and rounded never beveled; shell, less than three times its width in length; whirls, short, but the upper is as wide as at least all of the next six following.



A, tooth of a Tridentistrophia. B, tooth of Diacerion, both enlarged.

60 STROPHIA STRIATELLA Ferussac.

Striped Strophia.

Plate II, fig. 5, front, fig. 6, side view of type.

Pupa striatella Ferussac, Hist. Nat. des Moll. Page 206, plate 159, fig. 11 and 13; 1820–1851.

DESCRIPTION.

SP. CH. Size small; shell quite thick. Whirls 6. Examined 25 specimens.

Form of shell, oblong ovate, with the first and second whirls about equal in diameter, then the shell slopes to a semi-obtuse point. The striations are numerous, forty-one to the first whirl. They are narrow, not wider than the interspaces, furrowed, straight, and a little inclined to the right.

Aperture, nearly circular, this is about as wide as it is high. It is small, somewhat contracted at the entrance and measures a little more within than at the outer edge. The lower tooth is .12 long by ·03 high, is about central in position and is set back about .16 from the frontal bar. Both the teeth behind this are about the same sizes as the central, but from its position the outer is longer than the inner. The upper tooth is about as high as the central and extends back around the column.

Margin, not produced forward quite as far as the diameter of the shell, is considerably inclined to the left, beyond the side. It is somewhat thickened, measuring .05, is rolled over and rounded, slightly furrowed and polished, but is not flanging, there being a slight depression only behind it. The frontal bar is well developed, completely interrupting the striations, which, although they do not appear within it as prominences, may be seen through the opaque covering of the mouth.

Color of shell externally, shining white, mottled irregularly with rather longitudinal patches of pale reddish brown; internally, pale brown becoming whiter on the teeth and margin.

DIMENSIONS.

Size of typical specimen .75 by .35. Largest specimen .85 by .45; smallest, .65 by .32. Longest specimen .85; shortest, .65. Longest diameter, .45; smallest, .30.

OBSERVATIONS.

There is but little important individual variation in the specimens examined, aside from size. The two back teeth vary a little, and one specimen of which I have made a section, has the inner much shorter than the outer. Another has one well defined tooth in the beginning of the second whirl, and another slightly developed in front of it.

There can be no doubt but what this is the species which Ferussac had in hand when he described his Pupa striatella, for he clearly states that the teeth are prolonged back into the interior of the shell, as may be seen by his decsription given below, taken from his work cited at the head of this article. I have selected as a type a shell which closely agrees with his figure and dimensions given, namely, 20 mill. long by 9 mill. wide.

Following is Ferussac's diagnosis in Latin of which I also give a translation.

"P. testa profunde rimata, oblongo-ovata, solida, candida, strigis sparsis longitudinalibus fuscis, interruptis, ornata, confertim costata; costis filiformibus, rectis; spira apice obtuse conica, laevigata, pallide cornea; anfractibus novem ad decem planiusculi, angusti, ultimus, antice ascendens, basi vix compressus; apertura semiovalis, intus alba vel fulvida, dentibus duobus profundis altero in pariete aperturali, altero ad columellam, coarctata; peristomata, subincrassatum, brevissime reflexum, marginibus callo junctis, columellari patente."

Shell profoundly rimate oblong oval, solid, white, ornamented with a few interrupted lines of fuscous, ribs near together, thread like and straight. Apex of spire obtuse, very smooth, pale brown. Whirls, 9 and 10, evenly following one another, narrow, the first ascending in front with the last but little compressed. Aperture, semioval, white or a little yellow within. Teeth, two, one deep in the fold of the aperture, also another one on the column. Peristome, thick, short and reflexed, closely joined to the margin. Column, open.

On the next page he also speaks of one tooth which is prolonged into the interior of the shell, his exact words being as follows.

"Plus bas s'eleve une dent interieure, s'appuynt sur l'avant-dernier tour, et se prolongeant assez loin daris l'interieur de la coquille."

I found the shells in the museum collection correctly labeled Pupa striatella, Cabo Cruz, Cuba, the label being in the handwriting of Rafael Arango, who collected many of the Strophias in the museum.

In another large lot of shells of this species examined, I find that in a number of specimens the inner of the two back teeth is greatly reduced in size sometimes not being longer than the outer. I also find that there is a well developed form as given below.

Form No. 1, smaller than the type, measuring .60 by .30, with eight whirls only. Color and form similar to that of the type. There are about six per cent of this form. I have a single specimen in my collection which is in every way similar to typical S. striatella, but which differs in having smaller teeth and in being pure white in color, without markings.

61 STROPHIA MARMORATA Pfeiffer.

Marbled Strophia.

Plate III, fig. 1, front, fig. 2, side view of a typical specimen.

Pupa marmorata Pfeiffer, Zeitschr., f. Mal. p. 83, 1847. et. Helic. Viv., Vol. II, 1848, p. 323.

DESCRIPTION.

Sp. Ch. Size, medium. Shell rather heavy. Striations present. Whirls 9, the upper, of which, with the margin, considerably exceeds in length all of the others put together. Examined 40 specimens.

Form of shell, an obtusely pointed cylinder, with the first and second whirls about equal in diameter, the third is a little smaller and from this the shell slopes to an obtuse point, forming an angle of about sixty-five degrees.

The striations are numerous, about forty to the first whirl, are not prominent, are rounded and slightly widened; they are about as wide as the interspaces between them, are rather regular, straight and inclined a little from right to left. The whirls are slightly bulging, but the suture between them is shallow.

Aperature, quite large and widely open not at all contracted within and is somewhat higher than wide. The lower tooth is small, about .04 high, and about twice as long as high. It is inclined to be double, the second tooth appearing as a wide mass to the left, but extends backward rather farther than the true tooth. The lower tooth is placed a little to the right of the centre and well within the mouth, about twice its length from the frontal bar. The upper tooth is about as high as the lower, but is thinner and extends back around the column. It is placed quite high on the column and somewhat back of the outer termination of the lower.

The margin is not produced forward beyond the diameter of the shell, and is inclined backward at the top, and slightly to the right, a little beyond the diameter of the shell; it is thin, measuring not over .03 is reflexed outward about .08, is rolled over a little, and the edge, although prominent, is not sharpened, but smoothly rounded. The frontal bar is quite well developed, but is not produced outward beyond the diameter of the shell and is slightly inclined; it completely interrupts the striations, which do not appear within it.

Color of shell, externally, white, marked with longitudinal spots of a rather pale yellowish brown; these markings being seldom broken into horizontal lines by the encroachment of white; internally, pale yellowish brown, fading into white on the teeth and margin. The markings are thicker and rather more regular on the spiral whirls.

DIMENSIONS.

Size of typical specimen .90 by .42. Largest specimen, 1.21 by 50; smallest,.90 by .40. Longest, 1.21; shortest, .80. Greatest diameter, .50; shortest, .40.

OBSERVATIONS.

There is little varation among the specimens examined other than is due to age or to mere varieties in markings. There is, however, one well marked form as given below. Form No. 1, larger, measuring 1.15 by .50. The form is a little more cylinderical than the type, the first three whirls being equal in diameter, the color is similar, but the tooth is larger, being at least three times its height in length, and is also inclined to be double. There are about ten per cent of this form.

There can be no question but what this is the shell which Pfeiffer had in hand when he described his Pupa marmorata in his works cited at the head of this article, as color, form, size, etc indicate. Below, I give the original description and a translation.

"T. rimata-pefrorata, subcylindraco-ovata, solida, striatula nitidi, nivea, flammis longitudinalibus castaneis, diaphanis ornata, spira sursum attenuata, apice obtusa; anf. 10 subplanulata, ultimus autice plicatus; columnella obsolete et profunde unidentata plica parietis aperturalis mediocris, profunda; apertura semiovalis, intus lividofusca; perist, incrassatum, reflexum, marginibus superne convergentibus —Long, 24, diam. vix 10 mills. ap. 9 mill. longa, 8 lata (Coll. Philipp.).

Obs. Differt a praecedenta colore, apertura lateore, dente parietis aperturalis obsoletiore, dente columellari minimo, etc."

Shell rimate and perforated, sub-cylindrical ovate, solid, striated shining white, ornamented with longitudinal, transparent, flames of chestnut, which are alternate on the spire. Spire obtuse; whirls, ten, sub-even. The last plicated in front; column obscurely and deeply one-toothed, pariatal fold of the aperture, deep. Aperture, semioval livid fuscous within. Peristome, not thickened, reflexed. Margin, partly converging. Length, 24 mill. diameter, 10 mill. Aperture 9 mill. long 8, wide. (Collection of Phillip.).

Observation; differs from the preceeding, in the color, width of aperture, smaller tooth in aperture, and smaller tooth on the column etc.

The species referred to by Pfeiffer as "the preceeding," is his Pupa sagraiana. In this connection see remarks under S. obscura.

I found these shells in the collection labeled "Pupa marmorata Pfr., Cabo Cruz, Cuba. Cisneras, collector."

This species may be distinguished from the sub species S. m. polita, as described under observation in that form, from all others by the thin, scarcely flanging margin, numerous striations, and pale brownish, usually unbroken, longitudinal markings.

62 STROPHIA MARMORATA POLITA. Novo.

Polished Strophia.

Plate III, Fig. 3, front, fig. 4, side view of type.

DESCRIPTION.

Size, medium. Shell, rather thick and heavy. Striations, absent. Whirls, 9, the upper, including margin, being about equal in length to all of the others put together. Examined 25 specimens.

Form of shell, cylindrical, with the first three whirls equal in diameter, and from this the shell slopes to an obtuse point, forming an angle of sixty-five degrees. The shell is quite smooth being marked by some few, fine, but irregular lines of growth, which become rather more prominent on the upper whirl. The whirls are somewhat bulging with the suture rather deep.

Aperture. rather large and open, scarcely contracted within. The lower tooth is quite prominent, about .05 high nearly twice as long as high, accompanied on the left side by another tooth which is about half its height, yet which is as long as it, but which as it proceeds backward, diverges from it by curving around toward the column, thus the interior termination of the two teeth are nearly .10 apart and considerably widened. Both teeth are set back nearly twice their length, from the frontal bar and taken together are about central in position. The upper tooth is placed well up in the column, quite behind the outer termination of the lower tooth, is about as high as the larger, but rather thinner and extends around the column.

The margin is not produced forward beyond the diameter of the shell, is very slightly inclined backward and a little to one side, but not much beyond the diameter of the shell; it is thin, measuring about .05, is somewhat reflexed outward, about .04, and rolled over a little, but the edge is smooth. The frontal bar is quite well developed, and although it completely interrupts the striations, they can be seen through the translucent layer within it.

Color of shell, externally, yellowish white, marked with undulating longitudinal lines of yellowish brown which are more abundant on the spiral whirls, where many are as wide as the white interspaces between them. These lines are seldom broken by horizontal encroachments of white. Within, pale yellowish brown, becoming white on the teeth and margin.

DIMENSIONS.

Size of type 1.05 by .45. Largest specimen 1.25 by .50; smallest 1.00 by .40. Longest specimen, 1.25; shortest, 1.00. Greatest diameter, .50; smallest .40.

OBSERVATIONS.

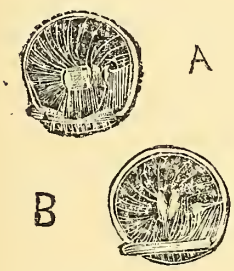
Variation consists in specimens being either lighter or darker than the type, in other words, the markings are more or less abundant, thus covering more or less of the surface of the shell. There is one distinct form as given below.

Form No. 1. Larger than the type, 1.25 by .50, otherwise similar.

This well marked sub-species differs from typical S. marmorata in the absence of striations, in the more cylindrical form of the shell, in the singularly diverging double teeth, and less converging margin. It is with considerable hesitation that I do not admit this form to full specific rank, but as I find some individuals which show evidence of intergradation, and as I found them in the same tray with the specimens of S.marmorata, described above, and consequently labeled as coming from the same locality (Carbo Cruz, Cuba.) I have thought it best for the present to consider them as sub-species only.

The difference in the teeth given above, in two such closely allied forms as S. marmorata and S. m. polita is worthy of note, as it exactly coincides with the theory, which I have had occasion to mention that the teeth of the members of this genus are vital characters, for as the animals have no muscles which grow to the shell anywhere, they depend largely upon the teeth as a means for holding themselves on the shell, therefore, with any change of environment which would tend to alter the weight of the shell would also tend to change the form of teeth. In the accompanying cut fig. 2 A. I give a figure of the teeth of S. marmorata and at ib. B, the same of S. m. polita.

Fig, 2.



A, Teeth of Strophia.
B, Teeth of S. m. polita.
Sectional view of shells.

There is a group of land shells which occur in the island of Mauritius, now included in the family Pupidae, which are closely allied to Strophia, and which possess similar teeth. In these shells the evolution of the teeth, both upper and lower, is clearly indicated. At first it is evident that the margin about the aperture was projected forward all around, when the animal for some reason lost its attachment for the shell, and required a tooth, then a portion of the margin, below the mouth, was bent inward, afterwards becoming dedatched to form a tooth; afterwards a second was formed in a similar way.

64 STROPHIA MUMIOLA Pfeiffer.

Little Mummy Strophia.

Plate IV, fig. 1, front, fig. 2, side view of typical specimen.

Pupa mumiola Pfeiffer, Wiegm. Arch., 1839, I, p. 353, and Helic. Viv. II, p. 848, 324.

DESCRIPTION.

Sp. Ch. Size small, shell, thick and heavy. Striations, present. Upper whirl with margin, about equal in length to all of the others put together.

Form of shell, an obtusely pointed cylinder, with the first three whirls equal in diameter, from the last of these the shell slopes abruptly to an obtuse point, forming an angle of about sixty degrees. The striations are about twenty to the first whirl, are rather prominent, rather regular, a little inclined to the left, are rather wide, but not quite as wide as the interspaces between them. They are slightly furrowed, smoothly rounded and polished. The whirls are not bulging, and the suture between them is quite deep.

Aperture, rather large and open, about as high as wide, and not contracted within. Lower tooth, not prominent, about .03 high, and about twice as long as high. It is about central in position, but is set far back in the mouth of the shell, at least twice and a half its length from the frontal bar; the upper tooth is about the same height and extends around the column.

The margin is not produced forward beyond the diameter of the shell, it is a little inclined backward, and a little to the right beyond the side of the shell. It is a little thickened, measuring .03. It is rolled over, and somewhat reflexed outward, about .05, and the edge is sharpened. The frontal bar is quite well developed, and considerably inclined; the striations do not appear within it.

Color of shell, externally, rusty brown, marked with zigzag, longitudinal spots of white which are often broken into transverse lines. Internally, pale yellowish brown, becoming white on the margin.

DIMENSIONS.

Size of typical specimen, .80 by .35. Largest, .90 by .36; smallest, .75 by .32. Longest specimen, .80; shortest, .75. Largest diameter, .36; smallest, .32.

OBSERVATIONS.

There is a little variation in the thickness of the margin, some specimens measuring about .10, and in some the margin is consider-

ably inclined to the right. The markings of this shell recall those of Strophia mumia, in fact the general form is similar, but the margin is proportionately less flanging and thicker. The resemblance is, however, sufficient to suggest the name of P. mumiola, which Pfeiffer applied to it and beyond all doubt, it is the species which he had in hand when he described his Pupa mumiola, as will be seen by his description given below.

T. breviter et profunde rimata, oblongo-ovata, solidula, corneo et albido subtiliter marmorata, remote costata; costis subrectis, validis, interstitiis costas multo superantibus; spira sub-cylindrica, apice subito in conum obtusiusculum attenuata; anfr. 9 convexiusculi, ultimus 1-3 longitudinis subaequans, antice ascendens; apertura lata, sublunaris, dentibus 2 profundis, altero intrante in ventre anfractus penultimi altero minuto superne ad columellam coarctata; perist. subincrassatum, undique expansum, marginibus callo tenui junctis. Long .20, diam. 9 mill. Ap. oblique 9 mill. longa, 8 lata. (Coll. Nr. 37.) Habitat in insula Cuba.

Translated the above reads as follows. Shell, short and deeply rimate, oblong ovate, solid, horny and white, finely marbled, striations wide apart and partly straight, the interspaces wider than the striations spire sub-cylindrical. Tip, partly cone-shaped and obtusely pointed; whirls 9, convex, the last one-third the length of the whole, front, ascending; aperture, on one side, sub-lunate, teeth two, deep. One in the interior of the belly of the front whirl, the other small and high on the column. Peristome, sub-thickened, somewhat expanded. Margins, connected by a narrow bar. Length, 20 mill. width 8 mill. Habitat, Cuba.

I found these specimens in the collection labeled "Pupa chrysalis, Cuba."

SUB-GENUS 8. SENICULUS.

LOWER TOOTH CENTRAL, NOT GREATLY ELONGATED. STRIATIONS, ALWAYS PRESENT, AND IRREGULAR IN FORM. SHELL, MARKED WITH IRREGULAR, TRANSVERSE LINES OF MIXED WHITE AND REDDISH. MOUTH, WIDELY OPEN, WITH MARGIN FLANGING. Type Strophia mumia, Brung.

This singular group of Strophias, which appears to be perfectly distinct, is characterized by the widely flanging margin, which in the type reaches the maximum development of all Strophias, rather short, low central tooth, which does not exceed three times its height in length, (see plate V for a section of S. mumia) and rough, irregular striations, combined with the mixed white and reddish colors, that appear in narrow, broken horizontal lines. The septa between the whirls

in the interior of the shell, are quite smooth even on the upper whirls.

For comparison between this and other sub-genera, see remarks under sub-generic characters which are to follow. Strophia mumiola belongs to this group also the next species, S. media.

[Note ; I have purporsely avoided mentioning to what sub-genera I consider some of the shells already described in this volume should be placed, as I have not yet seen sufficient material to fully warrant so doing.]

Note on Strophia mumia.

I found a large number of shells in the collection, which I have at present referred to this species, labeled as coming from Cabo Cruz, Cuba. This definitely fixes the locality for one form of the sub-genus and other similar species, (of which I have little doubt there are several) will probably be found to occur quite near. Unless otherwise convinced by the most unimpeachable evidence, it will be well for conchologists always to keep in mind that as species among Strophia, are, with very few exceptions, much restricted in distribution, sub-generic groups will also be found to be restricted. For further remarks in this connection, see observations under Strophia regia.

All of the specimens of what I have for the present considered as S. mumia in the museum collection, about 150 in all, although differing from the type form described and figured in Vol. 1, page 190-91 in having a less flanging margin, agree in general character, and exhibit no marked variation, but there is one well developed form given below.

Form No. 1. Smaller than the others, 1.30 by .50, otherwise similar. There are about ten per cent of this form.

64 STROPHIA MEDIA Novo.

Medium Strophia.

Plate IV, fig. 3, front, fig. 4, side view of type.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thick and heavy. Whirls, 10 the upper of which, including margin, is not quite as long as all of the remaining whirls together. Examined 2 specimens.

Form of shell, an obtusely pointed cylinder, with the first two whirls equal in diameter, the fourth is but little smaller, then the shell slopes to an obtuse point, forming an angle of about sixty-five degrees. The striations are few, prominent, but more so on the lower whirls than on the upper, eighteen to the first whirl, they are regular not

straight, of varying widths, and all excepting on upper whirl are wider on the upper portions than on the lower, but usually a little narrower than the interspaces between them. Some are furrowed, but the majority are smoothly rounded and polished. The whirls are a little bulging, and the suture is quite deep.

Aperture, widely open, but rather contracted deep within. The lower tooth is small, about .03 high, and rather more than twice as long as high; it is about central in position, and is set back not quite twice its length from the frontal bar. The upper tooth is not as high as the lower, but extends back around the column.

The margin is produced forward about as far as the diameter of the shell, and is slightly inclined to the right, and a little beyond the side of the shell. It is reflexed outward about .10, is a little rolled over, and the edges are sharpened and roughened by breaking. The frontal bar is thin and scarcely developed in the middle, and the striations appear within it as prominences which increase in size far back within the shell.

Color of shell, externally, yellowish white, marked everywhere with longitudinal, zigzag lines of reddish brown, which are occasionally broken into lines. Internally, pale yellowish brown, becoming white on the margin.

DIMENSIONS.

Size of type, 1.20 by .50. Size of one other specimen examined 1.17 by .50.

OBSERVATIONS.

This species differs on one hand from S. mumiola by the much larger size and more flanging margin, and on the other from S. mumia by the smaller size, at least .10, than the smallest specimen of the true Mummy Strophia, in the comparatively smaller mouth, less flanging margin, predomination of the white color, with a tendency in the red markings to assume longitudinal patches, which are rather less brokeninto horizontal lines. The two specimens found in the collection were simply labeled, "Cuba."

65 STROPHIA FERRUGINEA Novo.

Rusty Strophia.

Plate IV, fig. 5, front, fig. 6, side view of type.

DESCRIPTION.

Sp. Ch. Size, small. Shell, rather thick. Strations, present.

Whirls 9, the upper of which, including margin, is about as long as the remaining whirls together. Examined 9 specimens.

Form of shell a pointed cylinder with the first three whirls about equal in diameter; below these the shell slopes to a rather obtuse point, forming an angle of sixty degrees. Striations, rather numerous, twenty-six to the first whirl, not very prominent, quite regular, straight, not furrowed, rounded and polished and a little narrower than the interspaces between them; they are slightly flattened and enlarged on the lower portions just above the suture. The whirls are bulging on the upper third.

Aperture, small, slightly contracted within the entrance. The lower tooth is quite high about .05, and is three times as long as high. It is set back about once its length from the frontal bar. The upper tooth is about one half the height of the lower, but extends back around the column; it is placed high, about half way up the side of the aperture.

The margin is not produced quite as far forward as the diameter of the shell, is a little inclined forward, and a little to the left, but scarcely beyond the side of the shell. There is but little development of the frontal bar. The striations appear within the bar, but not as prominences. The margin is thin, about .03, is a little reflexed outward and although it is not much rolled over, is not beveled, and the edge is a little sharpened.

Color of shell externally, rusty red with striations white; internally, purplish brown, becoming paler on the margin.

DIMENSIONS.

Size of type .90 by .25. Largest specimen, .90 by .40; smallest, .78 by .37. Longest specimen .90, shortest, .75. Greatest diameter, .40; smallest, .35.

OBSERVATIONS.

The chief variation in the few specimens of this singular species which I have seen is in the thickening of the margin in some specimens and in the size.

I know of no other species of Strophia which agrees with this in the peculiar bulging of the whirls on their upper parts, combined with the flattening and enlarging of the striations on the lower portion in the depression of the whirls. The color is also peculiar, and is quite unlike that of any species of Strophia which I have seen.

I found these shells in the collection bearing the label "Washed up by the tide near Jeremie, Cote de Fer." Jeremie is in Hayti, on the

south western portion. The "Cote de Fer," or iron shore, is quite a common name in the West Indies, and is applied to any rough, rock-bound line of coast.

66 STROPHIA OBSCURA. Novo.

Obscure Strophia.

Plate III, fig. 5 front, fig. 6, side view of type.

DESCRIPTION.

Sp. Ch. Size medium. Shell rather thick and heavy Striations, absent. Whirls 9, the upper of which is about equal to all of the others put together. Examined 50 specimens.

Form of shell, a pointed cylinder, with the first two whirls equal in diameter, from this the shell slopes to a rather acute point, forming an angle of about 50 degrees. The shell is quite smooth, marked with faint and irregular lines of growth, which scarcely assume any prominence even on the upper whirl. The whirls are not bulging and the suture is shallow.

Aperture of medium size, quite open and slightly contracted within. The lower tooth is small, about .04 high, about twice as long as high; is single, is set back at least twice its length from the frontal bar, and is situated a little to the right of the centre. The upper tooth is about as high as the lower, but extends back around the column, is set well back, begining about in the middle of the lower, but is not set high up on the column

The margin is not produced forward beyond the diameter of the shell, is slightly inclined back at the top, and a very little to the right, scarcely beyond the diameter of the shell. It is a little thickened, about .05) is rolled over and reflexed outward a very little, (about .03) and the edge is smoothly rounded. The frontal bar is quite well developed, but is not much inclined.

Color of shell externally, bluish white, obscurely marked with zig-zag, longitudinal lines of very pale yellowish brown. These markings are scarcely to be seen with the unaided eye on the upper portion of the shell, but are a little better developed on the spiral whirls, where they are rather more regular and numerous. Internally, flesh color becoming white on the margin.

DIMENSIONS.

Size of type 1.10 by .42. Largest specimen, 1.15 by .50; smallest .98 by .40. Longest specimen 1.15, shortest, .98. Greatest diameter .45, smallest, .40.

OBSERVATIONS.

Some specimens are propotionately shorter than others and there are rather more markings on some than others, many being less marked than the type. There is one well defined form as given below.

Form No. 1. More slender and more cylinderical than the type the first three whirls being about equal in size, 1.05 by .43. The suture between the whirls are quite shallow and there are few fleckings which are confined to the lower four or five whirls.

I found these shells in the collection labeled "Pupa sagraiana Pfr., Cayo Birde del Norte, Cuba."

This is not the Pupa sagraiana of Pfeiffer, however, as can be readily seen by reading his description with care. He says distinctly that sagraiana is elegantly marbled, that there are narrow striations, besides his shell was much smaller, not quite an inch long, and very slender, about .40 in diameter. It was also a differently proportioned shell as the aperture was as wide as the diameter of the shell, and very nearly as high, thus the shell was at least one fourth shorter than any specimen of S. obscura that I can find, but the aperture was fully as large.

Further on, he gives a larger form calling it Beta major, says that it is marbled with fuscous and smooth, but the size of this is given as 26 mill. by 10 mill. This is much too small for any shell of S. obscura. Pfeiffer's types of P. sagraiana came from Cayo Galinda, Cuba where he says Dr. Gundlach found it common, and it is probable that we shall have to see shells from that place before we find the true P. sagraiana.

66 STROPHIA CYCLOSTOMA Kuester.

Circular Strophia.

Plate IV, fig. 3, front, fig. 4, side view of type.

Pupa cyclostoma Kuester, Chemn., ed. II, Pupa, page 9, plate I, figs. 3 and 6, 1852.

DESCRIPTION.

Sp. Ch. Size, small. Shell, rather thin. Striations, present. Whirls, 9, the upper of which, including margin, is equal to the next six. Examined 35 specimens.

Form of shell a pointed cylinder, with the first three whirls about equal in diameter, then the shell slopes to a rather obtuse point, forming an angle of about sixty degrees. The striations are thirty-seven to the first whirl, narrow, not wider than the interspaces between them, they are somewhat angled, but the tops are smoothly rounded and pol-

ished, regular and somewhat arranged in lines and are very slightly inclined from right to left. The whirls are not bulging, and the suture is shallow.

Aperture, small, not widely open, not contracted within, circular, being about as high as wide. The lower tooth is small, and short, about .03 high and about twice as long as high. It is set back a little more than once its length from the frontal bar. and is placed a little to the right of the center. The upper tooth is placed half way up the side of the aperture, but back of the lower; it is about as high as the lower and extends back around the column.

The margin is not produced forward quite as far as the diameter of the shell; it is a little inclined backward, but is not inclined to the right, being straight, yet it projects a little beyond the side of the shell. It is a little thickened, about .03, is rolled over, but is not flanging, thus the face is smoothly rounded. The outer edge is not produced backward, but is sharpened. The frontal bar is not well developed, being nearly absent in the middle.

Color of shell, externally, yellowish white, with rather broad, longitudinal stripes of reddish brown, which are frequently broader than the white interspaces, and which are not much, if at all, encroached upon by white lines. Internally, reddish brown, becoming paler on teeth and margin.

DIMENSIONS.

Size of typical specimen, .65 by .30. Largest specimen, .72 by .32; smallest, .60 by .30. Longest specimen, .65, shortest, .60. Smallest diameter, .30, largest, .32.

OBSERVATIONS.

Individual variation consists in a greater or less number of markings. There are two well marked forms.

Form No. 1, larger than the type, nearly white in color, nearly unmarked. The margin is thicker, and the aperture rounder. Size, .75 by .35. Whirls, 9.

Form No. 2, smaller than the type, color similar, size, .60 by .30. Whirls 8.

This is beyond all doubt, the Pupa cyclostoma of Kuester as both his description and figure would seem to indicate. A translation of his description is given below.

Smaller than the foregoing species; this is through its shape related with it, being connected with it through the hanging lip. While it is connected with P. uva with the continuous free lip. From P. uva it is distinguished by its color. The shell is oval-cylinderical; above, a lit-

tle sharpened, as it is also in P. uva, it is a little diminished toward the tip, walls somewhat thin and polished. Column smooth.

The rest of outer surface is beset with very numerous fine striations, somewhat angled, with interspaces about the same width. The striations are somewhat curved on the upper whirls and are quite prominent, but on the lower whirls are quite straight. The whirls, ten in number, are not bulging, (a little convex) about straight; bound together by a single deepened furrow (suture). Mouth about round, on the wall of the mouth a strong fold (lower tooth), a second smaller one on the columella. The margin of the mouth continuous, with a thick, produced lip reflexed outward. Ground color yellowish white, with pale reddish yellow spots, which for the most part are spread into the interspaces between striations. Mouth pale yellowish. Height 9''' length 3 2-3.''' Habitat unknown."

I have based the foregoing description upon specimens in my own collection, but I found none in the museum collection. All are simply labeled "Cuba."

68 STROPHIA MICROSTOMA. Pfeiffer.

Little-mouthed Strophia.

Plate VI, fig. 1, front, fig. 2, side view of type.

Pupa microstoma Peiffer, Malak. Blat., 1854, page 207, plate 3, figs. 15 and 16.

DESCRIPTION.

Sp. Ch. Size, small. Shell rather thick. Striations, present. Whirls 9. The upper, including margin, being about equal in length to all of the others put together. Examined 52 specimens.

Form of shell a pointed cylinder with the first three whirls equal in diameter, from this, the shell slopes to a rather acute point, forming an angle of fifty-five degrees. The striations are twenty to the first whirl, narrow, being about one half the width of the interspaces between them, straight on all excepting the two upper whirls, where they are slightly bowed to the right; they are regular, but not arranged in lines are not furrowed, but are smoothly rounded and polished. The whirls are not bulging and the suture is rather deep.

Aperture, small, somewhat contracted within, circular, about as wide as high. The lower tooth is very small, being reduced to a mere tubercle, which is but little longer than high; it is placed a little to the right of the center and far back in the mouth, at least four times

its length from the frontal bar. The upper tooth is also a mere tubercle, is placed at least as far back as in the lower, but extends back around the column.

The margin is produced forward about as far as the diameter of the shell, is a little inclined backward, and slightly to the right, beyond the diameter of the shell; it is very thin, a little rolled over, with the edge sharpened. The frontal bar is very slightly developed, merely extending from one striation to the other, thus filling in the interspaces but not crossing the striations. The striations appear within it, even more prominently than on the outside, and they occur on the septa throughout the entire length of the interior of the shell.

Color of shell. externally, bluish white, marked with rather longitudinal patches of pale reddish brown which are irregularly distributed over the surface of the shell, and which are scarcely more abundant on the lower whirls than on the upper.

DIMENSIONS.

Size of typical specimen, .75 by .32. Largest specimen, .76 by .35. Longest specimen, .77; shortest, .63. Largest diameter, .32; smallest, .25.

OBSERVATIONS.

Individual variation consists in more or less markings, but these are never so numerous as to form the predominating color of the shell as in S. cyclostoma. One of the chief external characters of this shell is the sharply defined striations which rise abruptly from the shell. In S. cyclostoma these rise gradually from the shell at a considerable angle and are finer. The teeth are set further back in S. microstoma and are less prominent. Another noticeable internal feature in this species is the prominences of the striations, not only at the mouth, but also on the septa quite to the lower whirls.

There are four well defined forms as given below.

Form No. 1. Pure white in color, without fleckings. The mouth is rather more contracted and the striations are less prominent, otherwise similar to the type.

Form No. 2. White in color, unflecked, but larger (.75) and more cylindrical, the first four whirls being about equal in size. Whirls 10.

Form No. 3. Colored as in the type, but much more slender proportionately, and much smaller, size, .62 by 25.

Form No. 4. Very small, but otherwise a miniature of the type, size, .57 by .27.

I found these specimens in the collection labeled "Strophia microstoma ? Cuba."

This species is clearly described by Pfeiffer in the work cited at the head of this article, and his figures on plate 3 are excellent. The following is his original description.

"T. profunde rimata, subcylindrica, solidula, confertim leviter costata, albida, strigis fusco-corneis irregularites signata ; spira elongata, sensim in conum obtuscilum ; sutura impressa ; anfr. 10 vix convexiuscula, ultimus 1-3 longitudinis non aequans antice leviter ascendens basi sub-compressus, aequte striatus; apertura lunato-rotundata, intus pallidé livida, dente parietuli compresso, intrante et plica columellari obsoleta munita ; perist. simplex, breviter expansum, marginibus callo tenui junctis, columellari dilatato, paltente,—long. 21—22 ; diam. 7 mill. ap. c. perist. 7 mill. longa, 6 lata."

The above may be translated as follows ;

Shell, deeply rimate, sub-cylindrical, solid, closely and lightly ribbed, white externally, marked with irregular lines of fuscous ; spire elongated, with the cone a little obtuse. Suture impressed. Whirls 10 scarcely convex, the last, one third longer than the others, front, a little ascending, base, partly compressed. Aperture, lunately rounded, pale livid within, parietal tooth compressed within, and the fold (tooth) on the columella obsolete. Peristome (margin) simple, short, expanded. Margins joined by a slender bar. Columella dilated, open. Length, 21-22, diameter, 7 mill. Aperture, 7 mill long, 7 wide.

69 STROPHIA RUDIS Pfeiffer

Red Strophia.

Plate VI fig. 5, front, fig. 6, side view of typical specimen.

Pupa rudis Pfeiffer, Malak. Blat. , 1855 ; page 102 ; Plate V, fig.1 and 2.

DESCRIPTION.

Sp. Ch. Size medium. Shell, thick and heavy. Striations, present. Whirls 10, the upper of which including margin is about as wide as the five following. Examined 6 specimens. Form of shell an obtusely pointed cylinder, with the first, second, and third whirls about equal in diameter. The fourth, is but little smaller and from this, the shell slopes to an obtuse point, forming an angle of about 65 degrees. The striations are numerous about thirty-eight to the first whirl ; they are narrow, about as wide as the interspaces between them straight or slightly bowed to the left and a greater portion of them are arranged in lines. The whirls are not at all bulging and the suture between them is shallow.

Aperture, rather small, but open, not rounded, about as high as wide. The lower tooth is quite prominent, about .06, a little more than twice as long as high, it is placed a little to the right of the center, and is set back once its length from the frontal bar. The upper tooth is very small, and is set back behind the lower, but is not placed high on the column.

The margin is produced forward about as far as the diameter of the shell, but is not much inclined to the right, only slightly beyond the side of the shell; it is thin, rolled over, with the edge sharpened. The frontal bar is only partly developed, not extending across from side to side, but the striations do not appear within.

Color of shell, externally and internally reddish, but evidently stained by contact with some red ochraceous earth.

DIMENSIONS.

Size of typical specimen, 1.12 by .42. Size of one other specimen, 1.10 by .40.

OBSERVATIONS.

There is but little variation in the few specimens which I have examined. The lower tooth is quite long, but not excessively so. This is a semifossil shell, and is beyond doubt the Pupa rudis of Pfeiffer. I append his description and a translation.

"T profunde rimata, ovata-oblongo, costis obtusis leviter arcuatis subconfertis sculpta, cretacea; spira convexiusculo-elongata, sensim in conum obtuseulum attenuata; anfr 11 vix convlxusculi, ultimus 1-4 longitudinis paulo superana, antice subascendens, juxta riman subcompressus; parietati et minore, profundiore collumelari, coarctata; perist. ciassum, breviter patulum, marginibus callo junctis, long. 30, diam. 12 mill. ap. c. perist 10 mill. longa, 9 lata.—Legitur subfossilis in plantationibus Dimond et Paradise in insulae St. Croix."

Shell deeply rimate ovate-oblong, ribs, blunt, a little arched, quite closely sculptured, chalky; spire elongated and convex, with the cone a little obtuse at the tip; whirls 11, scarcely convex, the last a little more than one-fourth longer, (than each of the others) front ascending, near the cleft greatly compressed; aperture, lunately round, parietal tooth small and compressed, the one on columella deep, and compressed; peristome, thick, short, open, margins joined by a slender bar. Length 30, diameter 12 mill, aperture of peristome 10 mill. long, 9 wide. Collected as a sub-fossil in the plantation, Dimond and Paradise in the Island of St. Croix.

SUB-GENUS 9. UMBONIS.

SHELL TURRET-SHAPED, LOWER TOOTH CENTRAL, MORE THAN THREE TIMES AS LONG AS HIGH. STRIATIONS, GREATLY ENLARGED, BULGING AND WIDENED IN THE MIDDLE, THESE AND THE INTERSPACES BETWEEN THEM ARE CROSSED BY FINE, TRANSVERSE DEPRESSIONS. APERTURE CONTRACTED, WITH A SLIGHTLY FLANGING MARGIN. UMBILICUS, CLOSED.

This is the most strongly marked group of Strophais which I have seen and is characterized by the turret-shaped shell, large, wide apart striations which are enlarged in the middle, giving each whirl a very abruptly bulging appearance.

But the most remarkable character of all, is the transverse lines or depressions which cross the shell everywhere, excepting on the first three whirls. This must be an old type of Strophia, or rather this singular feature must be one of the most primitive, for we find in many shells, even of widely different species, a tendency to revert toward this. See remarks under S. dimidiata. There are but two known species of this interesting sub-genus.

70 STROPHIA SCALARINA Pfr. et Gundl.

Embossed Strophia.

Plate VI, fig. 4 front, fig. 5, side view of type.

Pupa scalarina, Pfeiffer and Gundlach, Malak. Blat., 1861 p. 19.

DESCRIPTION.

SP. CH. Size, small. Shell, thin, striations present. Whirls 10, the upper of which, including margin, being about equal to the next four all together.

Form of shell, an oblong turret, with the first whirl the largest, from this the shell slopes to a rather acute point, forming an angle of forty-five degrees. The striations are few, twelve to the first whirl, very prominent, bulging, and enlarged in the middle, irregular, but not arranged in lines. The transverse, depressed lines appear on all but the four lower whirls, and are deeper on the upper whirl than elsewhere; they are about an equal distance apart, excepting in the middle of most of the whirls, where there is a band where they are absent; there are about twenty on the first whirl, directly below the aperture. The depression between the striations is about as wide as they, and the band, in which there are no transverse lines, also crosses these, but is narrower here. In the center of some of these depressions, are slight, longitudinal ridges or sub-striations. The suture is deep.

Aperture, very small, higher than wide, slightly contracted at the entrance. The lower tooth is about three times as long as high, is placed a little to the left of the center, and is set well back, nearly once its length from the frontal bar; the upper tooth is represented by a very slight tubercle.

The margin is not produced quite as far forward as the diameter of the shell, is placed far over to the right, and extends a little beyond the side, it is exceedingly thin, slightly flanging, but not rolled over at all and the edge is smooth. The frontal bar is comparatively well developed, very short, and the striations do not appear within it.

Color of shell externally, pale brown, but appears darker on account of the accumulation of earth in the transverse depressions; internally, also pale brown, becoming lighter on the tooth and margin.

DIMENSIONS.

Size of typical specimen, .75 by .25 Size of one other specimen examined, .70 by .25.

OBSERVATIONS.

I have seen two only of this remarkable species, which as Pfeiffer remarks, recalls the members of the marine genus, Scalaria. There need be no comparison made with other members of the genus as far as yet known, for none have the peculiar turreted form, large striations, which in this respect reach the maximum development among Strophias, while they also represent the minimum in numbers, and it is the most acutely pointed Strophia which I have seen.

The following is the original description from the work cited at the beginning of this article.

"T. profunda rimata, turrito-oblongo, solida, valide plicata, cornea, plicis albidis; spira subregularter attenuata, apice obtusa, anfr. 10 1-2 supreni planiusculi, striati, 6 ultimui convexi, subangulati, ultimus 1-3 longt fere foramens, basi compressus, striatus; apertura vix obliqua ovalis, denticulo profundo, parietuli coarctata; perist. subcontinunum, breviter adnatum, album, reflexum. Long 18, diam. 6 2-3 mill. Ap. c perist. 5 2-3 mill. longa, 4 1-2 lata. Hab. prope Gibara.

Translated may be read as follows. Shell, deeply rimate, turreted, oblong, solid, strongly plicated, ribbed outwardly, ribs white; spire, subregular, sharpened, tip obtuse, whirls, 10 1-2, somewhat even, striated, with the six last convex, sub-angular; the last one-third the others; with a little opening (umbilicus) compressed at the base and striated. Aperture a little obliquely oval, tooth deep, with sides compressed.

Peristome sub-continuous, short, connected, (by the frontal bar) white, reflexed. Length, 18, diameter 6 2-3 mill. Aperture of the peristome 5 2-3 mill. long, 4 1-2 wide. Habitat Gibara.

They also say that the specimens which they had were dead and bleached, and probably being worn they did not observe the singular transverse lines, whereas the two which I have in my collection, from which I have made the above description, were evidently living when found.

Gibara is on the northern shore of Eastern Cuba, about thirty-five miles west of Point Lucrecia Light-house. Although I have seen but a single species of this sub-genus, I have no doubt but what others will be found in the immediate vicinity.

SUB-GENUS 10. PINGUITIA.

FORM OF SHELL, SHORT AND THICK, THE WIDTH BEING AT LEAST ONE HALF THE LENGTH. THE FIRST TWO OR THREE WHIRLS ARE ABOUT EQUAL IN DIAMETER, WITH THE OTHERS ABRUPTLY SMALLER. TEETH, NOT PROMINENT. MARGIN, NOT BEVELED.

The most remarkable feature of this sub-genus is the short, thick form of the shell with its abrupt termination at apex, forming the widest angle of any known Strophia, over eighty degrees. There is but one known species.

71 STROPHIA DIMIDIATIA Pfeiffer.

Protean Strophia.

Plate VI, fig. 6 front, fig. 7, side view of type.

Pupa dimidiata Pfeiffer, Zeitshr. f. Mal., 1847, page 19.

DESCRIPTION.

SP. CH. Size, large. Shell thick and heavy. Striations, present on upper whirls. Whirls, 10, the upper of which, including margin is about as long as all of the rest put together.

Form of shell a very obtusely pointed cylinder, with the second whirl the largest, the first and third being a little smaller; from the latter named, the shell slopes abruptly to a very obtuse point, forming an angle of eighty two degrees. Striations not numerous, twenty-eight to the first whirl, they are confined to the first two whirls being reproduced on the others by roughened lines of growth; they are not prominent, narrow, about one half the width of the interspaces, irregular, furrowed, somewhat lengthened, and bent to the right at their lower terminations. The whirls are slightly bulging, and there is an elevated keel pass

ing around the center of the upper half of the upper whirl from one side of the margin to the other. The elevated lines in the middle of the upper part of the upper whirl is very prominent, and is precdeed above by a depression. When it is crossed by the striations it is raised into protuberances and ends in a prominent projection on the right margin. There are also numerous, transverse depressed lines on the upper whirls. The suture is quite shallow, even between the upper whirls, and this grows more and more shallow toward the apex until on the lower whirls it is scarcely to be distinguished with the unaided eye.

Aperture, rather small, but open, not contracted within. The lower tooth is not prominent, being tubercle, arising gradually from the floor of the mouth, without any sharply defined sides; it is placed to the right of the center and set back about .20 from the frontal bar. The upper tooth is scarcely developed at all.

The margin is produced forward about as far as the diameter of the shell, it is inclined a little backward on the upper left hand side, but elsewhere a little forward; it is about .05 thick, is rolled backward, somewhat, but not beveled, the edge is blunt; it is not inclined to the right. The frontal bar is quite well developed, slightly inclined and completely interrupts the striations, and the septa is smooth throughout.

Color of shell externally, yellowish white, pale flesh color within, fading into white on the tooth and margin.

DIMENSIONS.

Size of typical specimen, 1.02 by .64. Size of two other specimens 1.07 by .64, and 1.03 by .67.

OBSERVATIONS.

There is probably considerable individual variation, as well as some clearly defined forms in this singular species, it is also probable that there are sub-species and allied species, but the material which I have at hand will not warrant any, even sub-specific, separation. I give below one form, which was also observed by Pfeiffer.

Form No. 1. Similar to the type form, but without any distinct keel on the upper whirl, this being merely indicated, and the depressed lines are wholly absent, while the striations are confined to the two upper whirls.

These depressed lines, as already mentioned, show a tendency to revert toward S. scalarina, and in this connection it is worthy of note that both species came from the same portion of Cuba.

This species was first described by Pfeiffer in 1847 in Zeitschr. f. Mal., as Pupa dimidiata, but in 1861 in Malak. Blat. in a paper published jointly by himself and Dr. Gundlach, we find the same species redescribed and renamed Pupa proteus, because, as Dr. Pfeiffer states,

he considers that he did not fully appreciate the extreme variation to which the species was subject, therefore he did not at first describe a typical form, which in his second paper, he considers the keeled form. But of course, following modern usage, his second name becomes a synonym.

Dr. Gundlach states that the shell occurs on bushes and under leaves near Gibara, Cuba, and that the living animal is white or gray with the head and neck blackish with a blackish roughness, in contrast with which the white colors of the feelers [eye stalks?] show more plainly. The feelers have the tips gray.

The following is a transcription of Dr. Pfeiffer's description with a translation.

"T. rimata, cylindraceo-ovata, solida, distanter et arcuatim plicata, sordide alba: spira alveariformis, apice breviter conica; sutura levis; anfr. 11 angusti, planiusculi, supremi laevigati, ultimus dimidiatus, medio subcarinatus, infra angulum lineis nonnullis impressis, confertis. spiralibus notatus et excentrice confertim striatus, basi gibbus; apertura subsemicircularis; perist. incrassatum, expansum, marginibus callo stricto junctis, dextro subauriculato.—Long. 30, diam. 16 mill.—Ap. c perist. 13 mill. (oblique) longa, 11 lata. (Coll. Nr. 26.) Habitat in insula Cuba (Gruner).

Obs. Variat carina et lineis impressis basalibus obsoletis."

Shell rimate cylindrical-oval, striations wide apart and arched, soiled white: spire beehive-shaped, tips. short conical, suture smooth; whirls 11 narrow, even, the first smooth; the last divided in halves by a medium sub-keel, below the angle everywhere crowded, depressed lines. Spire with prominent and eccentric, crowded, striations, base swollen; aperture semicircular, peristome thickened, expanded, margin, joined by a narrow, straight, bar, sub-auricular on the right. Length .30, diameter, 16 mill. Aperture of the peristome 13 mill .long 11 wide, (Coll. No. 26) Habitat in the island of Cuba (Gruner).

Observations. There is a variety in which the impressed lines at the base are obsolete.

72 STROPHIA FAXONI.

Faxon's Strophia.

Plate VII, fig. 1 front, fig. 2, side view of type.

DESCRIPTION.

Sp. Ch. Size large for this sub-genus (Umbonis). Striations, present, shell rather thin. Whirls, 11, the upper of which, including margin, is as long as the next four.

Form of shell an oblong turret, with the first two whirls about equal in diameter, from the second, the shell slopes to an acute point, forming an angle of about forty degrees. The striations are few, thirteen to the first whirl, very prominent, bulging, not greatly enlarged in the middle, regular and crooked, and not arranged in lines. They are not an equal distance apart, but the interspaces between them are always twice as wide as the prominences; and there are longitudinal sub-striations indicated in some of the depressions. Both striations and interspaces are crossed by narrow, transverse lines, which are, however, everywhere about an equal distance apart, without any unmarked interruptions in the center of the whirls. These lines are about .01 apart, and there are about twenty of them on the first whirl beneath the frontal bar. The suture is deep.

Aperture, not very small, about as high as wide and open. The lower tooth is not prominent, rising gradually from the floor of the mouth, is about twice as long as high; it is about central in position, and is set back about once its length from the frontal bar. The upper tooth begins a little back of the lower, is about its size, and is placed low on the column.

The margin is not produced quite as far forward as the diameter of the shell, is inclined backward on the upper left side, and the lower right further than on the corresponding portions on the opposite side, in this respect resembling S. scalarina, hence this peculiarity becomes sub-generic. It is considerably flanging, especially on the right side, about .07, and here it is somewhat roughened by minute tubercles which are arranged in radiating or transverse lines. The frontal bar is very prominent, extending well out beyond the shell. The transverse striations appear on the right side of the tooth, and continue far within the shell.

Color of shell, pale yellowish, externally, but the specimens have evidently been cleaned and thus the transverse lines do not contain any soil. Within, very pale yellowish, becoming white on the margin.

DIMENSIONS.

Size of type, 1.12 by .40; size of one other specimen examined, 1.20 by .40.

OBSERVATIONS.

Rather singularly after my article upon S. scalarina was in type, I found two specimens of S. faxoni in the museum collection of which I

have just described, thus confirming my theory that there must be more species found of this remarkable sub-genus, for, although these specimens were simply labeled "Cuba," I have no doubt but what they came from the neighborhood of Gibara, Cuba.

S. faxoni differs from S. scalarina not only in being at least three times as large, but also in other important particulars. The form of the shell is rather different, the first two whirls being about equal in diameter, the margin is more flanging, and on the right side has the peculiar minute tubercles, arranged in lines. The striations are also quite different, being irregular, narrower and crooked, and not enlarged in the middle. I have named this species for Dr. Walter Faxon, who has displayed the utmost interest in my work upon Strophia and also has kindly aided me in many ways.

73 STROPHIA CYLINDRICA. Novo.

Cylindrical Strophia.

Plate VII, fig. 3, side, fig. 4, front view of type.

DESCRIPTION.

Sp. Ch. Size medium, shell thick and heavy. Striations, present. Whirls, 10, the upper of which, including margin, about equal in width to the next four all together.

Form of shell, an obtusely pointed cylinder, with the first three whirls equal in diameter, the fourth is but little smaller and from this the shell slopes abruptly to an obtuse point, forming an angle of sixty degrees. The striations are numerous, twenty-four to the first whirl, they are not very prominent, straight, but slightly bent to the left on the suture, and they extend along it, tapering into a point; they are polished above, not furrowed, arranged in lines, and are of varying width, but are never wider than the interspaces between them. The suture is very shallow and very narrow.

Aperture, quite small, not open, nor contracted within. The lower tooth is not more than .03 high, and is about four times as long as high, is set back about .12 from the frontal bar. Behind this central tooth on either side the chancelled tooth begins and extends around the first whirl. The upper tooth is about as high as the lower and extends back around the column.

The margin extends forward as far as the diameter of the shell, is a little inclined backward and very slightly to the right, but scarcely beyond the diameter of the shell. It is not thickened, is rolled over, but not flanging and the edge is rounded. The frontal bar is quite well

developed, yet the striations appear within it, but they are not very prominent and extend back far into the shell.

Color of shell, externally, shining white; within, deep purplish brown, pale on the tooth and internal striations. Margin, pale brown.

DIMENSIONS.

Size of type, 1.10 by .40. Largest specimen, 1.28 by .45; smallest .85 by .38. Longest specimen, 1.28; shortest, .85. Largest diameter .45, smallest, .35.

OBSERVATIONS.

Typical specimens are wholly white externally, but there is a strong inclination to become rosy at the apex, this feature is more prominent in the form given below. There are also other forms.

Form No. 1. Shorter, and proportionately stouter than the type. The apex is distinctly rosy and there are occasional lines of dark violaceous. This form exhibits a tendency on one hand to revert toward S. ianthina, and on the other toward S. rubicunda.

Form No. 2. Very short, .85, with the margin thickened and beveled. Color similar to that of form No. 1.

Form No. 3. Larger than the type, 1.28 by .45, with the margin much thickened, at least .75, and inclined to be double. Color, similar to that of the type.

Form No. 4. More slender than the type, measuring .35 in diameter, white in color.

I cannot give the relative proportions of these forms nor their exact locations, as I did not make sufficiently, careful notes on them when I collected them.

This is the species which in many collections is labeled Pupa alvearia, but erroneously, as I shall endeavor to show. The Turbo alvearia of Dillwin (Description Catalogue, II, page 315) was based partly upon the Alvearia buccinum of Seba and partly upon the Bulimus fusus of Burguiere (Encyclopedie Methodique, des vers, Vol. 1. page 348) hence must be considered as a synonym of Bulimus fusus. What the Alvearia, buccinum of Seba was, is very doubtful, but it is quite probable that neither he nor Burguiere had a true Strophia in hand, when they made their description, and even if they had, their description does not apply to any Inagua shell with which I am aquainted. Dillwin distinctly says his Turbo alvearia, was "white without and within" and this appears to be a correct interpretation of the authors upon whose description he bases his specific characters. Now this does not apply to any Strophia from Inagua which I have seen, for all, without exception

are colored within, none being white. even if they are wholly white externally.

The name alvearia, having become a synonym is not again available in zoological nomenclature and, as shown, Bulimus fusus of Bruguiere afterwards the Pupa fusus of more recent authors, probably is not a Strophia, but one of the peculiar members of the great family of Pupidae which occur in the Isle of France, to which locality it appears to be correctly assigned by Pfeiffer in his Monographia Helicorum Viventium, Vol. II, page 318, hence it remains for me to impose a new name upon the Inagua species.

DESCRIPTION AND HABITS.

I found the Cylindrical Strophia common in December, 1888, on the Island of Inagua, Bahamas. They were clinging to the trunks of small trees, just back of Matthewstown, and appeared to have a somewhat wide range, extending throughout the scrub lands from the town to the borders of the salina in the interior. December being a dry month, they were inactive, and firmly fastened to the trunks. They appeared to avail themselves of any natural cavity and had often wedged themselves into these so firmly as to be removed with difficulty. They were always gathered in groups of from three or four to twenty individuals.

SUB-GENUS 2. STROPHIOPS.

LOWER TOOTH, LOW. RISING GRADUALLY FROM THE WALLS OF THE MOUTH, SOMEWHAT ELONGATED, AT LEAST THREE TIMES AS LONG AS HIGH. UMBILICUS OPEN, WITH THE SAME DIAMETER, FOR SEVEN OR EIGHT UPPER WHIRLS.

This sub-genus was established by Dr. Dall in 1895, in the Bulletin of the Museum of Comparative Zoology, No. 9, Vol. XXV, pages 121-123, but in this group he also included all of the species found on the Cayman Islands which I have placed in the sub-genus Longidens (see page 39). This group appears to be confined to some of the outer Bahama Islands which lie along the Atlantic side of the Bahama Bank.

Thus Strophia alba S. lentiginosa and S. brownei from Rum Key belong here, also all of the species which I have described from Highborn Key but not from the keys about Allen's Harbor. For further remarks regarding the relationship between this sub genus and the Strophias which occur on the Cayman Islands, see Sub-Genus 11.

74 STROPHIA REGIA Benson.

Regal Strophia.

Plate VII, fig. 5, front, fig. 6, side view of typical specimen.

Strophia regia Benson. Ann. and Mag. Nat. Hist., 2d series, Vol. IV, page 125, August, 1849.

DESCRIPTION.

Sp. Ch. Size very large. Striations absent. Shell thick and heavy. Whirls, 11, the upper of which, including margin, is as long as the next five put together.

Form of shell a pointed cylinder, with the first whirl the largest, then each successive whirl is a little smaller to the fourth, and from this the shell slopes to a rather obtuse point, forming an angle of about sixty-five degrees. The surface of the shell is smooth, marked with irregular lines of growth, which are more prominent on the upper whirl near the margin. The whirls are not bulging, and the suture on the upper whirls is quite deep, but is much more shallow between the lower.

Aperture large and open, about as high as wide, not contracted at the entrance. The lower tooth is low, about .05, and is about three times as long as high, is about central in position, and is set back a little over once its length from the frontal bar. It rises gradually from the floor of the mouth, thus it is pyramid-shaped. The upper tooth is about the same form as the lower, and is about as high, but extends back around the column, ending on the beginning of the second whirl. It is placed half way up the column.

The margin is not produced forward quite as far as the diameter of the shell, is considerably inclined to the right, beyond the diameter of the shell, it is inclined backward on the upper right, and lower left corner; it is rolled smoothly over, and is considerably flanging, about .10, the edge is rolled over and roughened by breaking.

Color of shell, externally, shining white; internally, golden brown, passing with almost an abrupt line of demarkation back of the teeth into yellowish on the teeth and margin. Frontal bar slightly developed on either side, obsolete in the middle.

DIMENSIONS.

Size of typical specimen, 1.85 by .70; size of two other specimens 1.67 by .65, and 1.70 by .65.

OBSERVATIONS.

There is but little individual variation shown in the four specimens which I have seen of this fine species, which can readily be distin-

guished by the largest size (the largest Strophia known) smooth surface and widely open umbilicus, the column being about the same diameter for nearly its entire length.

This is not the Conchlodonta decumana of Ferussac (Prodromus page 462) nor is it the Pupa decumana of Pfeiffer (Mon. Helic. Vol. II, page 320) for his description is based upon Ferussac's, and both describe a species which differs from the true S. regia in at least two important characters, namely, in being irregularly and strongly ribbed, and in having the umbilicus imperforate. Pfeiffer, who says he had a specimen from the collection of Metcalf, gives St. Thomas as the habitat.

Although the present species should undoubtedly bear the name of S. regia, it is with some hesitation that I give Benson as the authority. In the Annals and Magazine of Natural History, 2d series, Vol. IV, August, 1849, page 125, Benson describes a shell which he calls Pupa regia, and which he says positively came from Nankin, China. Now although his description in general fits the species which I have given as Strophia regia very well, his dimensions are of a shell having widely different proportions, forexample, his shell was 44 millimeters long by 23 wide, hence his shell was a little more than half as wide as long, thus giving a width which in proportion to the length, is exceedingly rare in Strophia, and quite different from that of any S. regia which I have ever seen. There can be little, if any doubt, but what Mr. Benson was mistaken in saying the shell he described came from China, but how he came to give such a widely different width than is to be found in specimens of S. regia which came from Castle Island, Bahamas, is more difficult to say, and were it not for the fact that three years later, in 1852, Kuester, who was evidently familiar with Benson's type, gave a new description, (his dimensions being 19''' long by 7 1-2''') and an excellent figure of what we now know to be a typical Castle Island S. regia (Chem. ed II, Pupa, plate 17, figs. 13 and 14) I should be inclined to doubt that Benson had this species at all, but some other species which came from some different key. It is noteworthy that Kuester also gives the habitat of the species as Nankin, China, and it was not until about 1881, that conchologists became aware that this fine shell came from Castle Island, Bahamas.

I add Benson's original description from the work cited at the head of this article, with a translation. Benson in some prefatory remarks, seems quite elated over the fact that he has discovered such a

fine species of Pupa so far from the usual habitat of other members of the genus.

"T. profundissime umbilicata, elongato-conica, subcylindrica, solda, alba, laevigata, nitidiuscula, oblique et remote, obsoleteque plicato-striata; spira superne sensim attenuata, apice obtusiusculo; umbilico pevio; anfractibus undecim subplanulatis, ultimo antice ascendente, validus plicato, ab basin compresso; sutura lineari, irregulariter crenata; apertura obliqe truncato-ovata, sublaterali, ab axe deviante, intus fulvida; plica columellari profunda, duplicata, paretali elongata, remotiuscula; peristomate valde incrassato, reflexo, subtus latiori, extus angulum efformante, dextro medio antrosum arcuato.

Long. 43 mill. lat. 23; aperturae long. perist. incl. 18 mill. Lat. 9 millim. Habitat prope Nanking, China.

Brought by the late Dr. D. King, H. M. S. Cornwallis, and presented by him to Dr. Cantor, to whose kindness I am indebted for the specimen. A wire introduced into the umbilicus, will reach within a short distance of the summit."

Shell deeply umbilicated, elongated, cone-shaped; sub-cylindrical, solid, white, smooth, shining, striated folds indistinct. wide apart and oblique; spire, a little sharpened, with the tips somewhat obtuse, umbilicus open; whirls, 11, even, the upper ascending and strongly plicated, somewhat compressed; suture, linea and irregularly crenulated; aperture, oblique, slightly ovate, deviated a little to one side, brownish yellow within, tooth on the columellar deep, considerably elongated. Peristome, strongly thickened, reflexed a little, expanded laterally, without any angle, arched to the right of the center of the entrance.

43 mill. long by 23 wide; aperture, including peristome, 18 mill. long by 18 wide."

GENUS 11. LONGIDENS.

STROPHIOPS DALL (IN PART) SEE PAGE 33 FOR CITATION.

LOWER TOOTH GREATLY ELONGATED, FOUR TIMES AS LONG AS HIGH, AND ABOUT ONE FIFTH AS LONG AS THE SHELL. UMBILICUS, NEARLY OR QUITE CLOSED. APERTURE, NOT WIDELY OPEN. MARGIN NOT FLANGING, THICKENED AND BEVELED. Type S. pannosa.

The central tooth arises abruptly from the floor of the mouth, being narrow, not wider than high, even at the base. The difference between members of this sub-genus and those of Strophiops lies in the long tooth, which is about one fifth as long as the shell, whereas in the typeof Strophiops, S. regia, it is only about one eighth as long as the

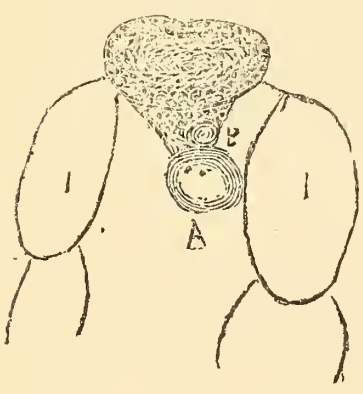
shell, in other words, the tooth in S. pannosa is absolutely as long as in S. regia, although the shell is only about half as large. The mouth in Longidens is not widely open, nor is the margin flanging, but thickened and beveled, and, above all, the umbilicus is nearly or quite closed, not widely open as in Strophiops. In Strophia, as I have already remarked, it will be found that the natural groups, which we call sub-genera, are comparatively limited in distribution hence the type of a given sub-genus should be selected from the area inhabitated by the greatest number of species. I have never yet seen a member of the sub-genus Longidens, taken off the Cayman Islands, which I regard as its proper habitation.

I have to thank Dr. Dall for kindly sending me his type of Strophiops, S. regia, for examination.

NOTES ON AN AGED LEGHORN HEN.

In the autumn of 1895, my friend, Mr. F. C. Browne of Framingham gave me a white Leghorn hen which, as near as he can remember, was about ten years old, and which had assumed secondary sexual characters, that is, she had the elongated tail feathers and hackles of the male. These began to appear in 1894, at which time she began to crow. That year she laid two eggs only. In 1895, she laid one only. When she came into my possession in October, 1895, she had evidently ceased crowing, for I did not hear her do so while in my possession.

Fig 3



Exhausted ovaries of Domestic Fowl.

When placed with some young Buff Cochins of my own, which were about two thirds grown, the old hen behaved much as a rooster would under similar circumstances, strutting about among the young pullets and uttering the peculiar sounds emitted by the males at such times, and she would also drive the young roosters about until they became quite frightened whenever she appeared.

She did not remain long with these fowls, however, but escaping one day, concealed herself among some weeds and bushes so effectually

PLATE I

1

2

3

4

5

6

PLATE II.

3

Strophia eurystoma Maynard.

4

1

Strophia fastigata Maynard.

2

5

Strophia striatella Ferussac.

6

PLATE III.

1

2

3

4

5

6

PLATE IV.

Strophia mumiola Pfeiffer

1 2

Strophia media Maynard

3 4

Strophia ferruginea Maynard

5 6

Strophia cyclostoma Kuester

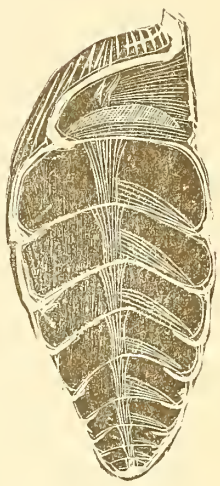
3 4

PLATE V.

Sections of Strophias to show sub-generic characters.

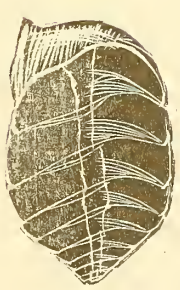
Strophiops Dall.

S. regia.



Longidens Maynard.

S. pannosa, (enlarged)



Pinguitia Maynard.

S. dimidiata.

Seniculus Maynard.

S. mumia.

PLATE VI.

1

Strophia microstoma Pfeiffer.

2

4

Strophia scalarina Pfr. et Gundl.

5

5

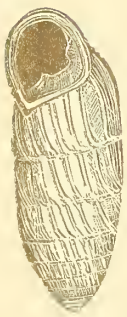
Strophia rudis Pfeiffer.

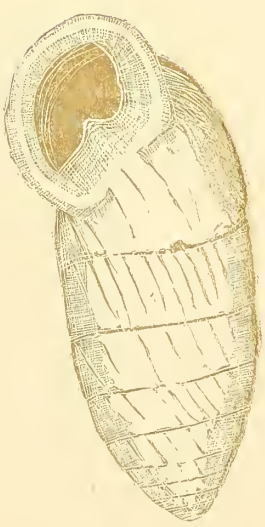
6

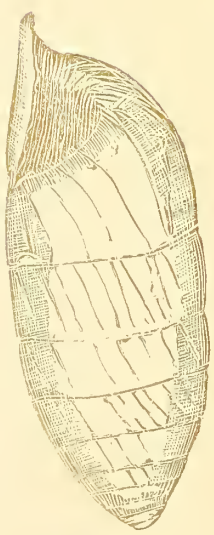
6

Strophia dimidiata Pfeiffer.

7







SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES

SMITHSONIAN INSTITUTION LIBRARIES

BOUND BY HNM

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 00565 2714